

**UNIVERZITA PALACKÉHO V OLMOUCI**

**PEDAGOGICKÁ FAKULTA**

Ústav pedagogiky a sociálních studií

## **Diplomová práce**

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The relationship between perceived stress, rumination, mobile phone addiction and academic achievement, and the protective effect of mental health literacy: A moderated chain mediation effect in the context of the Czech Republic and China

Olomouc 2024

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## **Declaration**

I declare that I prepared the diploma thesis independently and I have listed all sources and literature used.

V Olomouci dne 23. 4. 2024

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Mgr. Hongyang Liu

## **Thanks**

I would like to thank my thesis supervisor Mgr. Lucie Vachova, Ph.D., for her expert guidance and stimulating comments. At the same time, I would like to thank all the participating for filling out the questionnaire survey. Finally, I would like to thank my entire family and friends for their great patience and support throughout my studies.

## **Abstract**

This study delves into the intricate interplay between perceived stress, rumination, mobile phone addiction, and academic achievement, with a spotlight on mental health literacy as a crucial moderating element. It uniquely compares and contrasts two distinct student populations: Czech students from Palacký University, Olomouc, and Chinese students from Chongqing Normal University, Sichuan. Engaging a substantial sample size—1,075 Czech and 710 Chinese students—the research employs a methodical approach, utilizing online questionnaires via Google Forms and Wenjuanxing to collect data comprehensively.

The investigative tools include the Perceived Stress Scale, the Ruminative Responses Scale, the Short Version of the Smartphone Addiction Scale, a tailored Mental Health Literacy Scale, and the Academic Achievement Questionnaire. This arsenal of instruments is designed to provide a multifaceted view of the students' psychological landscape and its impact on their academic endeavors.

The analytical framework of the study is robust, encompassing descriptive statistics, correlation analysis, and moderated mediation analysis utilizing the PROCESS macro to decipher the nuanced relationships among the variables. The results unearth intriguing patterns: Czech students exhibit notably higher levels of perceived stress and rumination compared to their Chinese counterparts, who, conversely, display a more pronounced tendency toward mobile phone addiction. Notably, mental health literacy stands out as a differentiator, with Czech students showing a greater awareness and understanding in this area.

A deeper dive into gender dynamics reveals that, while perceived stress, rumination, and mobile phone addiction do not significantly vary by gender across the cohorts, Chinese female students emerge with significantly higher mental health

literacy levels than their male peers. This dimension adds a layer of complexity to the cultural comparisons.

The study's findings underscore the significant correlation between higher mental health literacy and enhanced academic performance, coupled with a reduced propensity for mobile phone addiction. However, the moderated mediation model offers a mixed picture: while it shows a poor overall fit, a closer examination within the context of study performance reveals a more nuanced understanding, particularly within the Chinese student cohort.

By shedding light on these intricate relationships and their variances across cultural contexts, the study makes a pivotal contribution to the understanding of how stress-related factors interplay with academic success, underscored by the moderating role of mental health literacy. This research not only adds to the academic discourse on stress and learning but also offers practical insights for educational policymakers, mental health professionals, and institutions aiming to foster environments that support students' mental well-being and academic achievement.

**Keywords:** Perceived Stress, Rumination, Mobile Phone Addiction, Academic Achievement, Mental Health Literacy

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# 1 Introduction

## 1.1 Background and significance of the study

Stress has been a pervasive and growing problem in our modern society, affecting individuals of all ages, genders, and backgrounds. Statistics reveal a troubling reality: stress among students is a genuine issue and can, in some instances, be on par with the stress that adults experience. The physical and mental demands of academic studies often increase in direct proportion to a student's progress (Reddy et al., 2018). Furthermore, external factors such as family life, finances, friends, and mental health can either provide a supportive role or present a hindrance to studying (Deng et al., 2022). According to a 2019 ACHA-National College Health Assessment II national research survey, the majority of undergraduates cited stress and anxiety as the top contributing factors that negatively impacted their academic achievement (Association, 2019). The 2019 National College Health Assessment found that 64% of college students reported experiencing overwhelming anxiety in the past year, up from 50% in 2011 (Edwards et al., 2021).

The phenomenon of student stress has garnered significant attention in the realm of educational psychology, with numerous studies underscoring its ubiquity and multifaceted nature across the globe. Stress among college students is a pervasive issue that transcends geographical boundaries, affecting individuals in both developed and developing nations (Gamonal-Limcaoco et al., 2022; Yasmineen & Liu, 2019). The sources of such stress are manifold, including academic pressures, financial concerns, social relationships, and future employment uncertainties (Bulo & Sanchez, 2014). International surveys, such as the Global Student Stress Survey (GSSS), have consistently reported high levels of stress-related symptoms among university populations, indicating a widespread challenge to student well-being and academic

success (Auerbach et al., 2018).

The impact of stress on students is profound, influencing not only their academic performance but also their physical and psychological health (Brown & Lee, 2017). Chronic stress has been linked to a range of negative outcomes, from decreased cognitive function and academic burnout to more severe mental health issues like anxiety and depression (McBride & Greeson, 2021). The transition to higher education itself is a significant stressor, with students having to navigate a new environment, increased workload, and the pressure of independence (Maymon, 2019).

Turning to the specific contexts of China, and the Czech Republic, the cultural and educational systems play a critical role in shaping the stress experiences of college students. In China, the legacy of the Gaokao, China's national college entrance examination, lingers even after students have entered university, with a continued emphasis on high stakes testing and academic achievement (Wen & Hu, 2023). Chinese students often face immense pressure to succeed academically, which is compounded by societal expectations and family obligations (Cao et al., 2021). Surveys conducted within Chinese universities have highlighted a prevalent culture of competition and a high incidence of stress-related issues among students (Tang et al., 2021).

In contrast, Czech college students encounter a different set of stressors. While the academic environment is also competitive, Czech students report stress related to the integration into the European Higher Education Area, with its attendant demands for mobility and multilingual proficiency (Kotera et al., 2021). Additionally, the Czech educational system's focus on self-directed learning can be a source of stress for students who are accustomed to more structured educational settings (Klobucar, 2008). Comparative studies between Chinese and Czech students have revealed that

while the manifestations of stress may differ, the prevalence and impact on student life are similarly significant (H. Liu et al., 2022).

The cultural context in which these students are embedded also influences their stress levels and coping mechanisms. In China, the concept of 'face' or social standing can affect how students manage stress, often leading to internalization rather than seeking help (Hashim & Zhiliang, 2003). Conversely, Czech culture may offer more social support systems, yet students may still struggle with accessing mental health resources due to stigma or lack of awareness (Kotera et al., 2022).

In addition, the COVID-19 pandemic has had a significant impact on college students' mental health and well-being. The pandemic has caused widespread disruptions to college life, including sudden transitions to remote learning, canceled or postponed events, and restrictions on social gatherings. These disruptions have led to feelings of uncertainty, anxiety, and social isolation for many college students (Salimi et al., 2023). The pandemic has also created financial hardships for many students and their families, as job losses and economic downturns have made it difficult for some to pay for college expenses. This financial strain can exacerbate existing stress and anxiety, and it can also limit access to mental health resources for those who need them (O'Connor et al., 2022). In China and the Czech Republic, two countries with different cultural backgrounds, college students also face similar stressors, including intense competition, high expectations from parents and society, and academic workload.

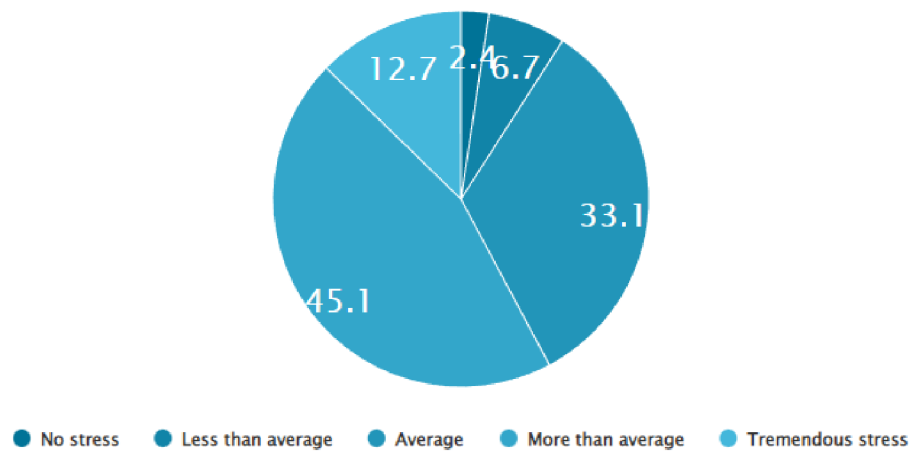
The transition to college life is often accompanied by increased levels of stress and pressure among students, which can significantly impact their academic performance (Rücker, 2012). Moreover, research suggests that perceived stress may not directly affect academic outcomes but can exert its influence through various

mediating mechanisms. Perceived stress serves as the foundation of our research. College students often grapple with elevated stress levels due to academic demands, social pressures, and the transition to adulthood. Stress can have profound implications for their mental health, academic performance, and overall quality of life. Therefore, understanding how perceived stress affects students is a fundamental aspect of our study.

While stress is a common experience, the way individuals perceive and respond to stress can vary greatly, depending on their cognitive styles, and coping strategies(Foster, 2005). One of the most common ways that individuals cope with stress is through rumination, which refers to the repetitive and passive thinking about one's negative thoughts and emotions, without actively trying to solve the underlying problems(Morrison & O'Connor, 2005). Rumination can provide temporary relief from stress by distracting the individual from the stressor but can also lead to prolonged distress by intensifying negative feelings, impairing problem-solving skills, and decreasing motivation and energy(Kuehner et al., 2009). Rumination has been linked to a variety of mental health problems, including depression, anxiety, and posttraumatic stress disorder, as well as academic difficulties, such as procrastination, lack of focus, and reduced creativity(McLaughlin & Nolen-Hoeksema, 2011). Rumination, the tendency to repetitively dwell on negative thoughts and feelings, is a known consequence of stress. It has been linked to prolonged stress experiences and can exacerbate its adverse effects. By including rumination as a mediating variable, we aim to explore how it may amplify the impact of perceived stress on students' well-being and academic achievement.

## How Stressed are Students?

Self-evaluated Stress Levels of College Students



Picture 1.1 Self-evaluated Stress Level of college students (Source: ACHA 2018)

Mobile phone addiction is a relatively new phenomenon that has emerged in the last decade, as mobile technology has become more ubiquitous and sophisticated. Mobile phone addiction refers to the excessive and compulsive use of mobile phones, to the point of interfering with daily activities, social interactions, and mental and physical health (Park, 2005). Mobile phone addiction can have a detrimental effect on academic achievement (Durak, 2019), by disrupting sleep patterns (Soni et al., 2017), decreasing attention and focus, and increasing procrastination and distraction. Students who are addicted to their phones may have difficulty disconnecting from their online social networks, games, and entertainment, and may experience anxiety and withdrawal symptoms when separated from their phones (Kong et al., 2020).

In recent years, researchers have become interested in exploring the relationship between mobile phone addiction and academic achievement among college students. One study conducted by Samaha and Hawi (2016) found that high levels of mobile phone addiction were associated with lower academic achievement among college students in Lebanon (Hawi & Samaha, 2016). Similarly, a study by Seo and Cha (2018)

found that excessive smartphone use was negatively associated with GPA and academic motivation among Korean college students(Cha & Seo, 2018). Academic achievement is a critical outcome variable in our study. It represents the primary goal of college attendance and holds implications for future opportunities and success. Understanding how perceived stress, rumination, and mobile phone addiction collectively influence academic achievement is pivotal for both researchers and educators.

Mental health literacy refers to the knowledge, attitudes, and skills that enable individuals to recognize, manage, and prevent mental health problems. Mental health literacy can affect individuals' ability to seek help, to cope with stressors, and to reduce stigma and discrimination. In the context of mobile phone addiction, mental health literacy may enable individuals to identify the signs of addiction, to seek professional help, and to adopt healthy behaviors and habits(Jeon et al., 2022). Recognizing the significance of mental health literacy, we introduce it as a moderating variable to highlight its role as a protective factor. College students with higher mental health literacy may possess better coping strategies and resources to mitigate the negative effects of perceived stress, rumination, and mobile phone addiction on their well-being and academic performance. This variable underscores the importance of promoting mental health awareness and education among college populations.

In summary, these five factors—perceived stress, rumination, mobile phone addiction, academic achievement, and mental health literacy—are interrelated components of a complex system that influences the lives of college students. By studying them together, we aim to unravel the intricate web of relationships among these factors and provide a comprehensive understanding of how they collectively



impact the well-being and academic outcomes of college students in distinct cultural contexts. Given the complex relationships among perceived stress, rumination, academic achievement, mobile phone addiction, and mental health literacy, there is a need for a comprehensive model that can explain and predict these variables. By examining the mediating and moderating effects of rumination, Big-five personality traits, and mental health literacy, this study aims to contribute to the understanding of the psychological processes underlying stress and addiction among Czech and Chinese college students. The findings of this study may have implications for the development of interventions and programs that target the underlying factors of stress and addiction, and that promote mental health and academic success.

The present study on creating a chain mediation model that concludes moderation is significant for several reasons. First, the study addresses the issue of perceived stress and its impact on academic achievement, which is a topic of great concern in the education sector (Reddy et al., 2018). Stress has been identified as one of the most significant factors affecting academic performance, and it has been linked to a range of negative outcomes, such as poor academic performance, low motivation, and emotional distress (Fincham & May, 2021). Therefore, understanding the underlying mechanisms that link stress to academic achievement is crucial for developing effective intervention strategies.

Second, the study aims to investigate the mediating role of rumination and mobile phone addiction in the relationship between perceived stress and academic achievement. Rumination and mobile phone addiction have been shown to be related to stress and can further exacerbate the negative consequences of stress (Michl et al., 2013). Identifying these mediating mechanisms can help to pinpoint areas of intervention that could potentially improve academic achievement by reducing stress

levels.

Third, the study proposes that mental health literacy plays a moderating role in the proposed model as a protective factor. Mental health literacy is the knowledge and understanding of mental health conditions, which can help individuals recognize and manage their own mental health and support others (MING & CHEN, 2020). By exploring the moderating role of mental health literacy, the study can shed light on the protective factors that can mitigate the negative impact of stress on academic achievement.

Fourth, the study utilizes a chain mediation model that concludes moderation, which is a relatively new analytical approach in the field of psychology. This model can offer a more comprehensive understanding of the complex relationships between the variables involved and can provide a more accurate prediction of the effect of stress on academic achievement.

Fifth, by conducting this study in both China and the Czech Republic, we aim to explore the cultural differences in the relationships among these variables and to provide cross-cultural evidence for the proposed model. The findings of this study will have practical implications for college students, educators, and mental health professionals in promoting mental health and academic success.

Finally, the study can have practical implications for educators, mental health professionals, and policymakers. By identifying the mediating and moderating factors that influence the relationship between stress and academic achievement, the study can inform the development of effective interventions and policies aimed at improving the mental health and academic performance of students. The results of the study can also contribute to the broader literature on stress and its impact on academic

achievement, which can inform future research in this area. Overall, the present study has significant implications for the improvement of student mental health and academic performance, making it an essential contribution to the field of education and psychology.

## 1.2 Research objectives and questions

The research objectives and questions of the present study aim to investigate the complex relationships between perceived stress, rumination, mobile phone addiction, mental health literacy, and academic achievement. These objectives and questions are as follows:

a. To examine the direct and indirect effects of perceived stress on academic achievement: The first objective is to investigate the direct effect of perceived stress on academic achievement in college students from Sichuan, China, and the Czech Republic. Additionally, the study aims to examine the indirect effects of perceived stress on academic achievement through the mediating variables of rumination and mobile phone addiction.

b. To investigate the mediating effects of rumination and mobile phone addiction on the relationship between perceived stress and academic achievement: The second objective is to examine the extent to which rumination and mobile phone addiction mediate the relationship between perceived stress and academic achievement. The study aims to identify the specific pathways through which perceived stress influences academic achievement.

c. To explore the moderating effects of mental health literacy on the relationship between perceived stress and academic achievement: The third objective is to investigate the moderating effects of mental health literacy on the relationship

between perceived stress and academic achievement. The study aims to identify the extent to which mental health literacy can buffer the negative effects of stress on academic achievement.

The research questions that correspond to these objectives are as follows:

- a. How does perceived stress directly and indirectly affect academic achievement? What is the magnitude of these effects in college students from Sichuan, China, and the Czech Republic?
- b. To what extent do rumination and mobile phone addiction mediate the relationship between perceived stress and academic achievement?
- c. How does mental health literacy moderate the relationship between perceived stress and academic achievement? What is the nature of this moderation effect?
- d. What are the practical and theoretical implications of the findings for promoting mental health and academic success in college students from different cultural backgrounds?

By addressing these research objectives and questions, the present study can provide a more comprehensive understanding of the complex relationships between perceived stress, rumination, mobile phone addiction, mental health literacy, and academic achievement. The study can help identify potential intervention strategies aimed at improving student mental health and academic achievement.

### 1.3 Research Paradigm

The methodological foundation of this study is grounded in the positivist and post-positivist paradigms. This section will delve into the defining characteristics of these paradigms and rationalize their applicability to the present study's objectives and methods.

### 1.3.1 Overview of Positivist/Post-Positivist Paradigms

Originating in the early 20th century, positivism is rooted in the belief that only "factual" knowledge, gained through systematic observation and measurement, is deemed reliable (Bryman, 2006). The evolved stance, post-positivism, while retaining the core principles of positivism, acknowledges the inherent limitations of human objectivity, positing that reality can be approximated but never fully captured (Phillips & Burbules, 2000).

Central to these paradigms are:

- A belief in an observable, singular reality that stands independent of human interpretation (Crotty, 1998).
- An epistemological stance emphasizing knowledge creation via objective observations, with a conscious effort to minimize biases (Guba & Lincoln, 1994).
- A preference for quantitative methodologies, advocating for structured tools like validated questionnaires, statistical analysis, and controlled observations to capture and dissect this reality (Creswell & Clark, 2017).

### 1.3.2 Relevance to the Current Study

In the quest to elucidate the relationships among perceived stress, rumination, mobile phone addiction, academic achievement, and the moderating influence of mental health literacy, this study employs standardized quantitative questionnaires. This approach seeks to capture an objective reflection of these constructs among college students from Sichuan, China, and the Czech Republic.

The usage of statistical analyses to discern patterns and relationships is a hallmark of the positivist/post-positivist paradigms and aligns seamlessly with this

study's methodological choices. The endeavor is to remain as detached and unbiased as possible, resonating with the tenets of these paradigms which advocate for a minimized subjective influence of the researcher (Bryman, 2006).

By anchoring this study in the positivist and post-positivist paradigms, we strive to achieve a rigorous, objective analysis of the delineated variables. The upcoming sections will detail the specific methods and tools employed, keeping in alignment with the foundational principles outlined here.

#### 1.4 Hypotheses

Based on the research objectives and questions, the present study proposes the following hypotheses:

**H1:** Perceived stress will have a significant negative direct effect on academic achievement.

This hypothesis proposes that perceived stress will negatively affect academic achievement, independent of any mediating or moderating variables.

**H2:** Rumination will have a significant mediating effect on the relationship between perceived stress and academic achievement.

This hypothesis proposes that rumination will mediate the relationship between perceived stress and academic achievement. That is, perceived stress will lead to rumination, which will in turn negatively affect academic achievement.

**H3:** Mobile phone addiction will have a significant mediating effect on the relationship between perceived stress and academic achievement.

This hypothesis proposes that mobile phone addiction will mediate the relationship between perceived stress and academic achievement. That is, perceived

stress will lead to mobile phone addiction, which will in turn negatively affect academic achievement.

**H4:** Mental health literacy will have a significant moderating effect on the relationship between perceived stress and academic achievement.

**H5:** The strength and direction of the relationships among perceived stress, rumination, mobile phone addiction, mental health literacy, and academic achievement will differ between college students from Sichuan, China, and the Czech Republic, due to cultural differences in stress, coping strategies, and attitudes toward mental health.

This hypothesis proposes that mental health literacy will moderate the relationship between perceived stress and academic achievement. That is, individuals with higher levels of mental health literacy will be less negatively affected by perceived stress in terms of their academic achievement.

In summary, the hypotheses propose that perceived stress will have a direct negative effect on academic achievement and that rumination and mobile phone addiction will mediate the relationship between perceived stress and academic achievement. Additionally, mental health literacy is proposed to have a moderating effect on the relationship between perceived stress and academic achievement. The hypotheses suggest that these factors are interconnected and that intervening on any of these factors can potentially improve academic achievement in students. The study will test these hypotheses using structural equation modeling (SEM) techniques.

The hypothetical model of this study is shown in Figure 1-2:

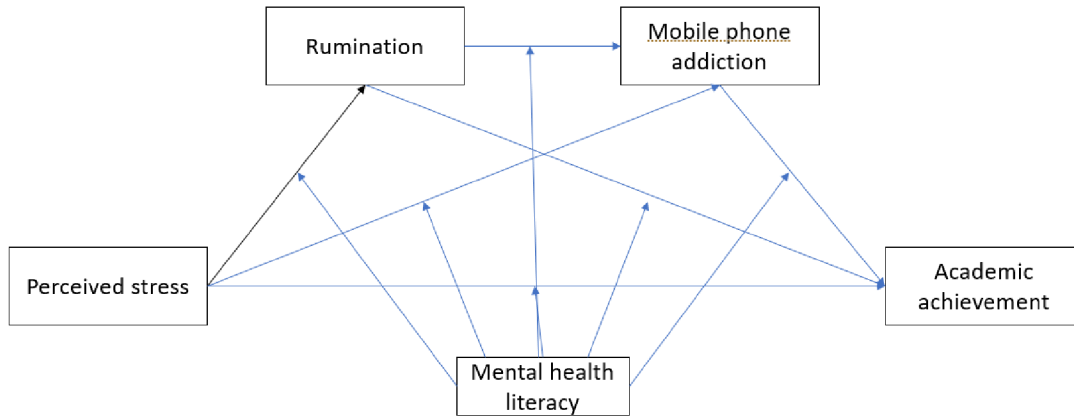


Figure 1-2 Moderated Chain Mediator Model.

## 2 Literature Review

### 2.1 Perceived stress

#### 2.1.1 Definition

The term "stress" often appears in a rather nebulous and inconsistent manner, with rare instances of a precise definition. This lack of clarity leaves room for interpretation, as "stress" can encompass various aspects, including a triggering event, one's reaction to said event, or the subsequent physiological consequences of that reaction. To address this ambiguity, this review opts to abstain from employing the term "stress," except when discussing the realm of stress research. Instead, we endeavor to dissect the multifaceted components that collectively constitute the concept (Kemeny, 2003).

First and foremost, we identify "stressors" or taxing life occurrences, which we define as circumstances capable of posing a significant threat to an individual's core objectives. These stressors encompass both those that endanger one's physical well-being, aptly labeled as "physical stressors," and those that jeopardize one's psychological equilibrium, termed "psychological stressors," as described by Lazarus



and Folkman in 1984(Lazarus & Folkman, 1984). The adverse psychological response to such challenges is termed "distress," encompassing a spectrum of emotional and cognitive states. These states can range from anxiety, sadness, and frustration to feelings of being overwhelmed or helpless. Researchers have made strides in classifying stressors into various taxonomies, with most categorizations distinguishing between threats to fundamental physiological needs, physical safety, social connections, one's sense of identity, and available resources.

Extensive research, spanning both human and animal studies, has consistently revealed the profound impact of exposure to stressors on a wide array of physiological systems(Oken et al., 2015). These specific alterations in the body's functioning are believed to have evolved to bolster behaviors necessary for coping with imminent threats, such as the instinct to fight or flee. To facilitate a swift and effective response, the organism orchestrates a mobilization of physiological systems that are pertinent to dealing with the threat at hand, while concurrently suppressing those systems that serve no immediate purpose.

For instance, when confronted with a threat, the body promptly elevates its glucose levels, providing an essential energy source to prepare the organism for physical action. Simultaneously, the body curtails processes related to growth and reproduction, recognizing that these functions are not immediately essential for addressing the imminent danger. While the body is well-equipped to withstand the acute activation of these threat-response systems with minimal harm, the chronic or repeated engagement of these mechanisms can have detrimental long-term consequences on both physiological functioning and overall health (McEwen, 1998; Sapolsky, 1992).

Perceived stress refers to an individual's subjective appraisal or evaluation of the

level of stress they are experiencing in a given situation or over a period of time(Hampel & Petermann, 2006). Perceived stress is a subjective experience, meaning that two individuals facing the same stressor may perceive and report their stress levels differently based on their unique perspectives and coping mechanisms. Perceived stress can arise from various sources, such as academic demands, social pressures, interpersonal conflicts, financial problems, and health issues(Rafidah et al., 2009). When individuals perceive that they cannot effectively manage the demands and challenges of their environment, they may experience negative emotions, physiological reactions, and behavioral changes that can affect their well-being(Worku et al., 2020).

Perceived stress has been linked to a range of negative outcomes in individuals, including psychological, physiological, and behavioral consequences. In terms of psychological outcomes, perceived stress has been associated with anxiety, depression, low self-esteem, and negative affectivity. Perceived stress can also affect individuals' cognitive processes, such as attention, memory, and decision-making, leading to reduced performance and academic achievement. Individuals who experience high levels of perceived stress may have difficulty concentrating, processing information, and retaining knowledge, which can affect their grades and academic progress(García-León et al., 2019; Rusli et al., 2008).

Physiologically, perceived stress can lead to the activation of the hypothalamic-pituitary-adrenal (HPA) axis and the sympathetic-adrenal-medullary (SAM) system(Farag et al., 2008; Schommer et al., 2003), which can result in the release of stress hormones, such as cortisol and adrenaline. Chronic activation of the stress response system can lead to wear and tear on the body, and increase the risk of various health problems, such as cardiovascular disease, metabolic disorders, immune

dysfunction, and mental health disorders(King et al., 2016).

Behaviorally, perceived stress can lead to maladaptive coping strategies, such as substance use, procrastination, avoidance, and aggression(Fincham & May, 2021; Wright, 2015). Individuals who experience high levels of perceived stress may resort to unhealthy behaviors, such as smoking, alcohol consumption, and drug abuse, as a means of coping with their stress. These behaviors can further exacerbate stress and lead to negative consequences, such as addiction, accidents, and social problems(Liu et al., 2018; Ng & Jeffery, 2003).

Perceived stress can also have a negative impact on social relationships, as individuals who experience high levels of stress may withdraw from social interactions, become less supportive, and experience more conflicts with others(Razurel et al., 2013). Stress can also affect the quality and stability of romantic relationships, leading to decreased satisfaction and higher rates of divorce or separation(Pinto et al., 2017).

It is worth noting that perceived stress is a subjective experience that can vary across individuals and situations. Some individuals may be more resilient to stress and may have better coping skills and social support networks that help them to manage their stress. In contrast, others may be more vulnerable to stress, and may lack the resources and skills necessary to cope with their stressors(Abolghasemi & Varaniyab, 2010; Shavitt et al., 2016).

Overall, perceived stress is a complex construct that can have a range of negative effects on individuals' psychological, physiological, and behavioral well-being. Understanding the factors that contribute to perceived stress, and developing effective interventions and coping strategies, may help to mitigate the negative consequences of

stress and promote resilience and well-being.

### 2.1.2 Measurement

The assessment of perceived stress is typically done using standardized self-report questionnaires. These questionnaires ask individuals to rate the frequency and intensity of stress they have experienced over a defined period, such as the past month or week. Some questionnaires are shown in table 2-1.

Table 2.1 The measurement of perceived stress

Name	Source	Items	Factors	Reliability
Perceived Stress Scale (PSS)	(Cohen et al., 1983)	10	Single factor	Cronbach's alpha =0.75-0.91; Test-retest reliability =0.60-0.85(Lee, 2012; Reis et al., 2010)
The Daily Stress Inventory (DSI)	(Brantley et al., 1987)	58	Work, family, finances, and health	Cronbach's alpha =0.75-0.88; Test-retest reliability =0.66-0.92(Brantley et al., 1988; Brantley et al., 1987)
Life Events Checklist (LEC)	(Gray et al., 2004)	17	Single factor	Test-retest reliability =0.69-0.90(Bae et al., 2008; Weis et al., 2022)
The Stressful Life Events Scale (SLES)	(Holmes & Rahe, 1967)	43	43 stressful life events from multiple social stress domains	Cronbach's alpha =0.85-0.90; Test-retest reliability =0.78-0.96(Liu et al., 2019; Liu & Tein, 2005)
Hassles Scale	(Lazarus & Folkman, 1989)	53	daily stressors, such as traffic, financial problems, or interpersonal conflicts	Cronbach's alpha =0.81-0.90; Test-retest reliability =0.70-0.89(Lazarus & Folkman, 1989; Pett & Johnson, 2005)

Considering the comprehensive nature and complexity of this study, the Perceived Stress Scale is designed to assess a person's perception of stress in a straightforward and focused manner. It is a unidimensional scale, meaning it primarily

measures the general perception of stress without including various subtypes of stressors. This simplicity aligns well with the objective of assessing overall perceived stress levels among college students. The PSS is one of the most widely used and well-validated self-report measures of perceived stress. It has been extensively tested for its reliability and validity across various populations, including college students (Choi, 2020; Zhan et al., 2021). These established psychometric properties ensure that you are using a reliable instrument. A single-factor scale like the PSS provides a clear and interpretable score for perceived stress levels. This simplicity in scoring facilitates data analysis and the interpretation of results, especially when examining the relationships between perceived stress and other variables in the research framework.

In summary, the Perceived Stress Scale (PSS) is an ideal choice for assessing perceived stress in this study due to its simplicity, ease of administration, established psychometric properties, cross-cultural applicability, and alignment with your research focus. By using this widely recognized and validated scale, it can effectively measure and analyze perceived stress levels among college students in Sichuan, China, and the Czech Republic while maintaining consistency with previous research and facilitating cross-cultural comparisons.

### 2.1.3 Theoretical basis: Cognitive Appraisal Theory of Stress

The Cognitive Appraisal Theory of Stress, proposed by Richard Lazarus and Susan Folkman, provides a solid theoretical basis for understanding the relationship between perceived stress and rumination. This theory posits that an individual's cognitive appraisal of a situation determines their emotional and physiological responses to it. In the context of this research, this theory helps explain how perceived stress leads to rumination, a process through which individuals' dwell on stressors and their associated thoughts and feelings.

The cognitive appraisal theory of stress encompasses four fundamental perspectives. Firstly, it underscores the significance of individuals' cognitive assessment of stressors, which is categorized into two distinct processes: primary appraisal and secondary appraisal (Lazarus & Folkman, 1984). During the primary appraisal stage, individuals focus on determining how external stimuli might impact their well-being. Primary appraisal consists of three types: irrelevant, benign-positive, and stressful. Among these, stress assessment can be further divided into harm/loss, threat, and challenge. In the context of the Cognitive Appraisal Theory, perceived stress corresponds to the primary appraisal. This is where individuals assess whether a particular situation or event is relevant to their well-being. When college students encounter academic pressures, social challenges, or other stressors, they engage in primary appraisal by evaluating the significance of these stressors for their academic success and overall life satisfaction.

In the secondary appraisal stage, individuals assess the characteristics of the stressful event. They contemplate the feasibility of various coping options, the likelihood of these strategies yielding the desired outcomes, and the effectiveness of employing a specific coping strategy (Folkman et al., 1986; Lazarus & Folkman, 1984). Secondary appraisal also entails evaluating one's available resources, which significantly influences how individuals cope with stressors. After perceiving a stressor, individuals engage in secondary appraisal to evaluate their ability to cope with the stressor. Rumination, in this context, can be seen as a cognitive response to secondary appraisal. It involves repetitive and often negative thinking about the stressor, one's ability to cope with it, and its potential consequences.

Based on these cognitive appraisals, individuals may respond to stressors in various ways, such as using problem-focused coping (taking action to address the

stressor) or emotion-focused coping (managing emotional reactions to the stressor). The theory highlights the importance of coping strategies and resources in dealing with stress. Individuals may modify their coping strategies based on their appraisals. When individuals perceive a situation as highly stressful, they may be more likely to engage in rumination as a coping strategy. This rumination, in turn, can intensify their perception of stress, creating a self-perpetuating cycle. This feedback loop between perceived stress and rumination can have a significant impact on mental health. Prolonged rumination can lead to heightened levels of distress, anxiety, and even depression, exacerbating the negative effects of perceived stress.

Researchers in psychology and related fields have studied the concept of rumination, its effects on mental health, and its role in coping with stress for many years, in other words, rumination is one of the negative ways of coping with stress. For example, in a study conducted by Michl et al. (2013), it was demonstrated that rumination serves as a notable coping strategy in response to stressors. The authors found that individuals exposed to stressful life events were more likely to engage in rumination as a response to distress. This observation suggests that rumination is not only a cognitive process but also a coping mechanism utilized by individuals when faced with challenging situations (Michl et al., 2013).

Rumination tends to amplify the experience of stress. When individuals ruminate on their stressors, they often become more focused on the negative aspects of their situation, leading to heightened emotional distress (Willis & Burnett Jr, 2016). In some research, rumination has been examined as a mediator between stress and mental health outcomes. This means that rumination may partially explain why stress leads to negative psychological effects, such as depression, anxiety, and low self-esteem, etc (Michl et al., 2013; Wang et al., 2018).

Regarding the sequence of primary and secondary appraisal, the initial theoretical perspective suggests that they may not necessarily occur sequentially but could transpire concurrently.

The Cognitive Appraisal Theory suggests that there can be a feedback loop between perceived stress and rumination. When individuals perceive a situation as highly stressful, they may be more likely to engage in rumination as a coping strategy. This rumination, in turn, can intensify their perception of stress, creating a self-perpetuating cycle. This feedback loop between perceived stress and rumination can have a significant impact on mental health (Spinhoven et al., 2015). Prolonged rumination can lead to heightened levels of distress, anxiety, and even depression, exacerbating the negative effects of perceived stress. When college students experience high levels of perceived stress and engage in rumination, it can interfere with their ability to concentrate, solve problems, and perform well academically. The constant cognitive preoccupation with stressors can lead to decreased academic productivity and success.

In summary, the Cognitive Appraisal Theory of Stress provides a theoretical framework to understand how individuals evaluate and respond to stressors. Perceived stress and rumination are interconnected within this framework, with perceived stress representing the initial appraisal of a stressor's significance and rumination representing a cognitive process that can exacerbate and prolong the stress response. This theory helps shed light on the cognitive mechanisms underlying the relationship between perceived stress and rumination, which is relevant to your research on college students and their well-being.

While the Cognitive Appraisal Theory of Stress is a valuable framework for understanding the relationship between perceived stress and rumination, it also has



limitations that should be considered in this study. The Cognitive Appraisal Theory simplifies the stress process into primary and secondary appraisal stages. While this simplicity can be helpful for conceptual clarity, it may not fully capture the complexity of the factors involved in the college students' experiences. For example, it may not adequately account for the various stressors and individual differences in how students perceive and respond to them.

The Cognitive Appraisal Theory may not adequately address the role of cultural factors in stress appraisal and coping. Cultural differences can significantly impact how stressors are perceived, interpreted, and responded to. Since this study involves participants from different cultural backgrounds (China and the Czech Republic), it's important to consider how cultural factors may interact with the theory's framework.

Mental health literacy is a multifaceted concept that encompasses knowledge, attitudes, and skills related to mental health. The theory doesn't provide a clear framework for understanding how mental health literacy moderates the stress appraisal process. You'll need to develop or draw from other theoretical models to explore the moderating role of mental health literacy effectively.

To address these limitations, this study will integrate the Cognitive Appraisal Theory with other relevant theories or frameworks, such as theories related to cultural influences on stress, individual differences in coping, or models that specifically address the role of mental health literacy in moderating stress responses. This integration will help create a more comprehensive understanding of the factors influencing college students' experiences of stress and their academic outcomes.

## 2.2 Rumination

### 2.2.1 Definition

Rumination can be described as the repetitive, prolonged, and recurrent engagement in negative thinking regarding one's self, emotions, personal concerns, and distressing experiences (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). Specifically, depressive rumination is characterized by persistent contemplation of the symptoms, causes, circumstances, meanings, implications, and consequences of a depressed mood and distress, as outlined in the Response Styles Theory (Watkins & Roberts, 2020).

The significance of rumination lies in its robust association with the development and perpetuation of depression (Nolen-Hoeksema, 2000; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008), as well as its connection to various other psychological disorders. This suggests that rumination may be a transdiagnostic pathological process (Ehring & Watkins, 2008; Nolen-Hoeksema & Watkins, 2011). As a testament to its perceived importance, research on rumination has experienced substantial growth over the years. For instance, by April 2019, there were a total of 7,197 papers related to rumination indexed in Web of Science. In the year 2000, 87 papers on this topic were published, which increased to 246 papers in 2008, and a striking 826 papers in 2018 (Watkins & Roberts, 2020).

Furthermore, numerous review papers have been dedicated to exploring various facets of rumination (Grierson et al., 2016; Nolen-Hoeksema et al., 2008; Pearson et al., 2011; Jeannette M Smith & Lauren B Alloy, 2009; Watkins, 2008; Watkins & Nolen-Hoeksema, 2014). This collective body of research and literature underscores the critical role rumination plays in mental health and its enduring relevance in the field of psychology.

An overarching discovery from both experimental and prospective studies is that rumination can intensify psychopathological conditions in at least four distinct ways:

a) Amplifying and Prolonging Negative Emotional States: One key impact is its ability to magnify and prolong pre-existing negative moods and the accompanying negative thought patterns. Experimental studies that deliberately manipulate rumination have consistently demonstrated its adverse causal effects on mood and mood-related cognitive processes in the short term. When such negative effects persist chronically or recur frequently, they are likely to contribute to the development of emotional disorders (Nolen-Hoeksema et al., 2008). In these experimental investigations, researchers often employ a standardized rumination induction protocol. Participants are explicitly instructed to contemplate prompts that direct their focus toward their own feelings, symptoms, and the causes and consequences thereof. This is typically compared with a distraction induction, in which participants are instead instructed to engage in imagining visual scenarios unrelated to themselves or their emotional states (Lyubomirsky & Nolen-Hoeksema, 1995).

b) The second adverse consequence of rumination is its detrimental impact on problem-solving abilities (Lyubomirsky et al., 1999), despite ruminators often reporting an increased sense of insight into their problems (Lyubomirsky & Nolen-Hoeksema, 1993). Experimental studies consistently reveal that rumination disrupts effective problem-solving in two significant ways: it fosters pessimism and encourages abstract thinking while inhibiting access to specific details required for resolving difficulties (Donaldson & Lam, 2004; Lyubomirsky & Nolen-Hoeksema, 1995; Lyubomirsky et al., 1999; Watkins & Baracaia, 2002; Watkins & Moulds, 2005). These effects have been observed even among dysphoric mothers with infants under 12 months (O'Mahen et al., 2015).

c) A third detrimental effect of rumination, as illuminated by experimental studies, is its interference with the promotion of active instrumental behavior, including a reduced inclination to engage in pleasurable activities (Lyubomirsky & Nolen-Hoeksema, 1993). Rumination has been associated with heightened uncertainty and decreased confidence in one's plans (Ward et al., 2003), as well as an increased tendency toward avoidance, both in cross-sectional research (Bishop et al., 2018; Giorgio et al., 2010; Moulds et al., 2007) and in prospective studies conducted over a 7-day period among undergraduates (Dickson et al., 2012). Moreover, in bereaved adults, baseline rumination has been shown to predict avoidance behavior at a 6-month follow-up, which subsequently mediates the impact of rumination on symptoms observed at the 12-month mark (Eisma et al., 2013).

d) Reducing Sensitivity to Changing Circumstances: Additionally, rumination reduces sensitivity to evolving circumstances and contextual shifts, further exacerbating its detrimental effects. Experimental research has unequivocally demonstrated that rumination has a detrimental impact on concentration and central executive functioning (Lyubomirsky et al., 2003; Watkins & Brown, 2002). Functioning as an internal and often abstract preoccupation, rumination is posited to diminish the sensitivity and responsiveness of individuals to contextual cues and external events in their surroundings (Watkins, 2008). This includes signals related to potential rewards, shifts in circumstances, or interpersonal interactions. This inward and abstract preoccupation may hinder ruminators from effectively adapting to changes in their environment or from reaping the benefits of corrective learning that challenges and refutes negative beliefs (Reilly et al., 2019).

### 2.2.2 Rumination as a mediator between perceived stress and outcomes

Rumination has been proposed as a mediator in the relationship between

perceived stress and negative outcomes, such as depression and anxiety.

Academic achievement is a critical outcome for college students, as it is associated with future employment prospects and opportunities (Tew, 1986; Zubairi & Jani, 2008). Perceived stress has been shown to be negatively associated with academic achievement, as it can lead to distraction, reduced motivation, and poorer performance on academic tasks (Rücker, 2012; Solomon, 2013). Similarly, mobile phone addiction has been linked to poorer academic achievement, as it can lead to distraction and reduced engagement with academic tasks (Ibrahim et al., 2018).

Rumination may mediate the relationship between perceived stress and academic achievement, as it can interfere with individuals' ability to focus on academic tasks and may reduce their motivation to engage in academic activities. The relationship between perceived stress and rumination is complex and bidirectional. Perceived stress refers to an individual's subjective perception of stress in response to a particular event or situation, while rumination refers to the tendency to repeatedly think about negative experiences or feelings, and to dwell on them without finding a solution or a way to move forward. Research has shown that individuals who experience high levels of perceived stress are more likely to engage in rumination (Willis & Burnett Jr, 2016). This is because rumination may be seen as a coping mechanism for dealing with stress, although it ultimately leads to more negative outcomes. When an individual is faced with a stressful situation, they may engage in rumination as a way of trying to make sense of the experience and find a way to cope with it. However, this can lead to a negative cycle in which the individual becomes stuck in their negative thoughts and feelings, leading to further stress and rumination (Watkins & Roberts, 2020).

Then some research has shown that rumination can have a negative impact on

academic achievement. This is because rumination can lead to decreased motivation, difficulty concentrating, and decreased ability to solve problems and think critically (J. M. Smith & L. B. Alloy, 2009). When a student is stuck in a cycle of rumination, they may find it difficult to focus on their academic work and may struggle to complete assignments or prepare for exams. This can ultimately lead to lower grades and overall academic achievement (Khan et al., 2019).

Furthermore, rumination can also lead to decreased self-esteem and increased feelings of anxiety and depression, which can further impact academic achievement. When a student is struggling with negative thoughts and feelings, it can be difficult for them to feel confident in their abilities and to perform at their best academically (McLaughlin & Nolen-Hoeksema, 2011; Spasojević & Alloy, 2001). Overall, the relationship between rumination and academic achievement is complex and depends on a variety of factors, including the type of rumination, the context in which it occurs, and individual differences in coping mechanisms and resilience.

On the other hand, mobile phone addiction is another outcome that may be influenced by perceived stress and rumination. Mobile phone addiction is characterized by excessive and compulsive use of mobile phones, which can interfere with individuals' daily activities and relationships. Perceived stress has been shown to be positively associated with mobile phone addiction, as individuals may turn to their phones as a way of coping with stress (Peng-Fei et al., 2020). Similarly, rumination has been linked to mobile phone addiction, as individuals may use their phones as a way of distracting themselves from negative thoughts and emotions (Liu et al., 2021; Zhang et al., 2021).

A study by Peng et al. (2022) found that perceived stress was positively associated with mobile phone addiction, and that rumination partially mediated this

relationship. These findings suggest that rumination may be a mechanism through which perceived stress influences individuals' mobile phone use, and that reducing rumination may be a useful target for interventions aimed at reducing mobile phone addiction (Peng et al., 2022).

Overall, these findings suggest that rumination may be an important mediator in the relationship between perceived stress and academic achievement and mobile phone addiction. Some coping strategies aimed at reducing rumination may be effective in improving academic achievement and reducing problematic mobile phone use among college students. Some potential coping strategies may include mindfulness-based techniques, cognitive-behavioral therapy, stress-management programs and enhancing mental health literacy. By targeting rumination as a mechanism through which perceived stress affects individuals' outcomes, these interventions may help individuals develop more adaptive coping strategies and improve their overall well-being.

### 2.2.3 Measurement

There are several ways to assess rumination, including Self-report measures, interviews, behavioral measures, etc. Self-report measures are the most used method for assessing rumination. These measures involve asking individuals to respond to a series of questions about their thoughts and feelings.

The most used self-report measure for rumination is the Ruminative Responses Scale (RRS), developed by Nolen-Hoeksema and Morrow in 1991. The RRS consists of 22 items that assess the frequency of ruminative thinking in response to negative affect, each rated on a 4-point scale (1 = almost never to 4 = almost always). (Susan Nolen-Hoeksema & Jannay Morrow, 1991). Participants rate how often they engage in specific ruminative thoughts, such as "I think 'what if' about past events" or "I think

about how sad I feel."

The RRS has been widely used in research and clinical settings and has demonstrated good reliability and validity. The internal consistency of the scale has been found to be high, with Cronbach's alpha coefficients ranging from .82 to .90 in various studies. The test-retest reliability of the RRS has also been found to be good, with correlations ranging from .63 to .79 over a 2- to 8-week interval(Han & Yang, 2009; Roelofs et al., 2006).

The Responses to Depression Questionnaire (RDQ) is a self-report measure of rumination developed by Nolen-Hoeksema and Morrow in 1991(S Nolen-Hoeksema & J Morrow, 1991). The RDQ assesses the frequency of different types of responses to depressive symptoms, including rumination. The scale consists of 25 items rated on a 4-point scale (1 = almost never to 4 = almost always).

The internal consistency of the RDQ has been found to be high, with Cronbach's alpha coefficients ranging from .84 to .93 in various studies. Test-retest reliability has also been found to be good, with correlations ranging from .67 to .84 over a 1- to 2-week interval(Sher-Censor et al., 2020; Wilkinson & Goodyer, 2006).

Interviews is another way to assess rumination, and they involve a trained interviewer asking questions to an individual about their thoughts, feelings, and behaviors related to rumination. Interviews can be structured or unstructured, depending on the specific goals of the assessment.

Structured interviews typically involve a set of standardized questions that are asked in a predetermined order. One example of a structured interview for rumination is the Problematic Rumination and Reflection Disorder Interview (PARDI), which is a structured clinical interview developed to assess problematic rumination, a newly



proposed diagnostic entity in the DSM-5 (Diagnostic and Statistical Manual of Mental Disorders, 5th Edition)(Dinkler & Bryant-Waugh, 2021).

The PARADI consists of 18 questions that assess the frequency, intensity, and duration of rumination, as well as the degree of distress or impairment it causes. The questions are designed to be asked in a specific order to guide the interviewer through the assessment process. The PARADI is typically administered by a mental health professional with experience in diagnosing and treating rumination disorders(Bryant-Waugh et al., 2019). The PARADI has demonstrated good inter-rater reliability, meaning that different interviewers using the same instrument are likely to come to the same diagnostic conclusions. It has also been shown to have good convergent validity, meaning that it correlates highly with other measures of problematic rumination, such as the Ruminative Responses Scale(Bryant-Waugh et al., 2022).

## 2.3 Mental health literacy

### 2.3.1 Definition

The concept of mental health literacy starts with health literacy, which was first proposed by the American scholar Simonds in 1974(Berkman et al., 2010). Health literacy is the ability to access health information, read it, understand it, and apply it to make health-related decisions, and to receive treatment as directed(Hewitt, 2012). With the development of society, the concept and connotation of health literacy are constantly enriched and developed. Health literacy was later defined by WHO as "health literacy represents the cognitive and social skills that determine an individual's motivation and ability to acquire, understand and use information, and to promote and maintain health through these means(Andrus & Roth, 2002).

The traditional concept of health is "no disease is healthy", however, the modern concept of health has changed, in addition to physical health, there is a strong resistance to disease, able to adapt to environmental changes, various physiological stimuli and the role of disease-causing factors on the body. The World Health Organization has proposed that "health is not only the absence of physical diseases, but also mental health, good social adjustment and morality". So, the health of modern people includes: physical health, mental health, spiritual health, social health, intellectual health, moral health, environmental health, etc. Health is the basic right of human beings. Health is the first wealth of life. Therefore, mental health is also an important category within the concept of health and is an inseparable part of it.

As mentioned above, mental health literacy is also included in the category of health literacy, although the concept of health literacy has been widely circulated, mental health literacy is rarely mentioned in it.

The concept of mental health literacy was originally introduced by Jorm in 1997 and defined as "knowledge and beliefs related to helping people recognize, manage, and prevent mental illness". Early mental health literacy consists of four elements: (1) the ability to recognize mental illness or psychological distress; (2) knowing how to seek mental health information; (3) knowledge and perceptions about risk factors for mental illness, causes, self-help interventions, and how to obtain professional help; and (4) attitudes that promote mental illness recognition and appropriate help-seeking (Jorm et al., 1997).

Soon after, Jorm went on to divide mental health literacy into 6 components: (1) ability to recognize some specific mental disorder or various types mental distress; (2) beliefs and knowledges about factors and causes of risks; (3) knowledges and beliefs about interventions for self-help; (4) knowledge and beliefs for available professional

help;(5) attitudes that help identify and seek help appropriately and(6) knowledge of how to seek mental health information(Jorm, 2000).

After years of theoretical and empirical research, Jorm et al. The main components of mental health literacy are: (1) knowledge of how to prevent mental illness; (2) knowledge of how to recognize mental illness; and (3) knowledge of the options and availability of help for mental illness; (4) knowledge of self-help strategies to effectively deal with less severe mental problems; (5) knowledge of how to provide assistance to people with early mental illness or individuals in mental health crisis(Jorm, 2012).

Taken as a whole, Jorm defines a concept that is more focused on knowledge related to mental illness, a definition that has received some scholarly support (O'Connor & Casey, 2015). We refer to this as narrowly mental health literacy in a narrow sense.

After the concept of mental health literacy was introduced, studies related to mental health literacy were gradually conducted in Australia(Wong et al., 2012), the United States(El-Amin et al., 2018), Canada(Kutcher et al., 2015), Japan(Koyama et al., 2009a), India(Ogorchukwu et al., 2016), and Europe(Angermeyer et al., 2009). The concept of mental health literacy proposed by Jorm et al. has been gradually developed in Australia, the United States, Canada, Japan, India, Europe and other countries and regions(Kermode et al., 2009; Kutcher et al., 2015; Lui et al., 2016). The concept of mental health literacy proposed by Jorm et al. has been recognized by a large number of scholars, but some scholars have also discussed mental health literacy based on different theoretical foundations and models.

The definition of mental health literacy and the content and theoretical structure

of the concept of mental health literacy. However, some scholars also put forward different views on the definition of mental health literacy and the content and theoretical structure of mental health literacy concept based on different theoretical bases and theoretical models.

Lauber et al. explained mental health literacy using the conceptual connotation of health literacy as the ability of individuals to acquire, understand, and use information to achieve the maintenance and promotion of mental health, emphasizing that mental health literacy is a part of health literacy (Lauber et al., 2003).

Based on Nutbeam's theoretical model of health literacy, American scholar Smith et al. (2007) believe that mental health literacy is a cyclical and systematic process in which individuals acquire mental health-related knowledge and attitudes through education, culture, media, internet, health service system, peers and various mental health education and training in their acquired environment based on basic health literacy. Based on the mental health knowledge and attitudes, individuals form their beliefs about mental health, and then use these acquired mental health knowledge and beliefs to form certain mental health maintenance and promotion skills, so that they can make appropriate decision-making behaviors, functional behaviors, communication behaviors, and critical behaviors to maintain and promote mental health (Smith et al., 2007). This concept is slightly different from the conceptual framework of mental health literacy proposed by Jorm et al. It takes the theory of health literacy as a starting point and extends the study from objective mental illness and mental health-related knowledge, situational attitudes and behavioral dispositions to individuals' perceptions of their It takes the theory of health literacy as a starting point and extends the study from objective knowledge about mental illness and mental health, attitudinal expressions and behavioral tendencies in specific contexts to

individuals' perceptions of their The study extends from objective knowledge about mental illness and mental health, attitudes, expressions and behavioral tendencies in specific situations to an individual's overall and subjective self-evaluation of his or her own knowledge, beliefs and abilities about mental illness and mental health problems. It is a supplement and improvement to the original concept of mental health literacy.

Other scholars argue that mental health literacy should be a broad concept that encompasses not only the knowledge component but also attitudes, stigma, positive mental health, psychological help-seeking, and help-seeking efficacy related to mental illness(Bjørnsen, Eilertsen, Ringdal, et al., 2017; Kutcher et al., 2016).

In defining mental health literacy, the Canadian Alliance on Mental Illness and Mental Health emphasizes the health promotion aspect of mental health literacy. Kutcher et al. (2016) analogize the evolution of the concepts of health literacy and mental health literacy and argue that mental health literacy should include the following components:(1) understanding how to achieve and maintain a positive mental health (2) understanding mental illness and treatment; (3) reducing the stigma associated with mental illness; and (4) enhancing psychological help-seeking efficacy. This is a definition of mental health and mental illness that encompasses knowledge, perceptions, attitudes, and skills, is more complete than Jorm's definition, and is supported by several scholars(Bjørnsen, Eilertsen, Ringdal, et al., 2017; Wei et al., 2015).

In summary, mental health literacy is still a concept in the process of refinement, and its connotation and extension have been in a state of development. Spiker and Hammer (2019) noted that researchers have consistently advocated for expanding the definition of mental health literacy to include more constructs, but However, there is

no consensus on which constructs should be included (Spiker & Hammer, 2019). This leads to the current problem that mental health literacy is currently difficult to measure, and it is difficult for researchers to ensure that the questionnaires they develop and revise actually measure what they want to measure.

Based on this situation, this study will first clarify the definition of mental health literacy. According to Jiang Guangrong et al. (2020), the conceptual definition of mental health literacy needs the following directions for improvement: (1) mental health literacy should include not only coping with mental illness but also the promotion of mental health maintenance; (2) the object of mental health literacy in terms of attitude should include the self in addition to others; and (3) the concept of mental health literacy should facilitate the integration of the original research areas. (4) Continue to study the difficulties in measurement methods and develop instruments with guaranteed validity that can be administered on a large scale (Jiang et al., 2020).

Based on the previous work, the researcher tried to define a new broad connotation of mental health literacy by combining the definition of mental health literacy given by many previous researchers before developing the questionnaire (Jiang et al., 2020; Jorm, 2000, 2012; Kutcher et al., 2016; MING & CHEN, 2020): The acquired ability that acquire and applicate the knowledge and skills related to mental health, and develop the attitudes and habits to maintain and promote individual's own and other's mental health. It means that knowledge, skills, and attitudes relate to the mental health of others in addition to individual's own mental health.

### 2.3.2 Measurement

Wei et al. (2015) reviewed 401 studies on mental health literacy in 32 countries from 2013 to 2015 and counted a total of 215 mental health literacy assessment instruments,

including 69 knowledge scales, 111 attitude scales (some named stigma scales), and 35 psychological help-seeking scales(Wei et al., 2015).Mental health literacy is initially assessed by situational case questionnaires, but in recent years a large number of instruments have emerged, both unidimensional and multidimensional; according to the response method, it can be divided into likert scales, right and wrong questions, short answer questions or filler questions; according to the content of the assessment, it can be divided into knowledge, attitude and psychological help-seeking scales.

#### 2.3.2.1 Situational case assessment questionnaire

Initially, Jorm et al. (1997) investigated the knowledge of risk factors for depression and schizophrenia and the causes of their onset using a case interview method in which he first presented subjects with cases of patients with mental illnesses described in lay terms and then asked them questions about identifying mental illnesses, the causes of their onset, and the risk factors that trigger them, the effectiveness of different treatments, attitudes toward patients with mental illnesses and post-treatment prevention of mental illness. The types of questions include open-ended questions and judgment questions. This led him to the earliest situational case assessment questionnaire for mental health literacy(Mental Health Literacy Questionnaire, MHLQ) (Jorm et al., 1997).

Many scholars have subsequently used this method to develop similar questionnaires. Burns and Rapee (2006) used a similar approach to develop The Friend in Need Questionnaire, which sets up a number of cases, including two cases of depression and three cases of daily living, each with five questions that can be used to assess the mental health literacy of the adolescent population. The questionnaire is simple compared to Jorm's questionnaire assessment, and in order to emphasize the autonomy of the subjects, the items are answered in a subjective fill-in-the-blank format without forced choice(Burns & Rapee, 2006).

Coles & Coleman (2010) revised the Mental Health Literacy Questionnaire for Anxiety Disorders (MHLQ-AD) based on the clinical case questionnaire of Brown, Campbell, Lehman, Grisham, and Mancill (2001). MHLQ-AD), which sets up one depressive disorder case and several anxiety disorder cases with three questions each

to test subjects' ability to identify and attribute mental disorders and suggestions for treatment. The questionnaire is easy to fill out with a small number of questions, and it is suitable for assessing the recommended mental health literacy of the adult population, so it is highly used(Chakawa & Shapiro, 2021; Coles et al., 2015; Currier et al., 2018).

The Canadian Alliance on Mental Illness and Mental Health (CAMIMH) commissioned the professional survey company COMPAS to design and develop a mental health literacy questionnaire. The questionnaire was designed to investigate the public's knowledge and understanding of mental illness and mental health issues, beliefs, and information related to mental health. COMPAS designed the questionnaire to include, in general, knowledge of the causes and influences of mental illness and mental health problems, knowledge of professional measures such as psychological interventions and psychotherapy, stigmatization of people with mental illness, assessment of their own mental health status, and knowledge of some methods and approaches to maintain and promote mental health(Marcus et al., 2012). Chinese scholars in Taiwan translated and revised the questionnaire into a traditional Chinese version to assess the mental health literacy of patients with depression and dementia(Chen, 2013).

Later researchers have inherited and developed this measure. On the one hand, the scenario of psychological disorders was expanded to include successively mania (Parker et al., 1999), eating disorders(Darby et al., 2012), conduct disorders (Furnham & Leno, 2012), autism (Koyama et al., 2009b), anxiety disorders (Hadjimina & Furnham, 2017), attention deficit hyperactivity disorder (Loo et al., 2012), and personality disorders (Furnham et al., 2015), among others. On the other hand, the questions were streamlined in terms of questioning, focusing on issues such as



identification of mental disorders, etiology of mental disorders, and effectiveness of different treatments (Reavley & Jorm, 2011).

The Situational Case Questionnaire is most widely used in the international assessment of mental health literacy. The advantages of this type of questionnaire are that it combines the symptoms of mental illness with the description of real-life situations, which makes the assessment of the ability to identify specific mental illnesses more realistic and effective, and the cases and questions can be set flexibly for the purpose of the study; The disadvantages are the low degree of standardization, the relatively time-consuming and laborious measurement, the lack of reliability and validity indicators, and the difficulty of statistical analysis (Kutcher et al., 2016; Zhi-jun & Zhi-yan, 2020).

#### 2.3.2.2 Single dimensional assessment tools

Unidimensional assessment tools are the tools that assesses only one of the components of mental health literacy. For example, questionnaires on the measurement of mental health knowledge, questionnaires on the identification of mental illness, and questionnaires on the stigma of mental illness. Some typical scales are shown in the table 2-2 below.

Table 2-2 typical single dimensional assessment tools of mental health literacy

Questionnaire Name	Researchers and years	Number of items	Evaluation Content	Evaluation Subjects	Reliability and validity
Mental health disorder recognition questionnaire (MDRQ)	(Swami, Persaud, et al., 2011)	20	Mental illness recognition	The British general public	Winer's intra-class reliability, $k(\text{real disorders})=.96$ , $k(\text{foils})=.94$
Mental Health Disorders Overclaiming Scale	(Swami, Papanicolaou, et al., 2011)	30	Familiarity with the names of psychological disorders	The British general public	None
Mental Health Knowledge Schedule(MAKS)	(Evans-Lacko et al., 2010)	12	Knowledge about the stigma of mental illness	Adults aged 25 to 45 years in socioeconomic groups	$\alpha= .65$
Mental healthpromoting knowledge measure(MHPK-10)	(Bjørnsen, Eilertsen, Bradley, et al., 2017)	10	Positive Mental Health Knowledge	Norwegian upper secondary school students	A test-retest correlation coefficient above .70; $\alpha= .84$
The Community Attitudes toward the Mentally Ill (CAMI)	(Garcia et al., 2017)	27	Authoritarianism, Benevolence, Social restriction, and Community mental health ideology	Students from La Source School of Nursing Sciences at the University of Applied Sciences and Arts of Western Switzerland	$\alpha= .87$

Mental Health Knowledge Questionnaire (MHKQ)	(Gao et al., 2018)	20	Public knowledge and awareness of mental health	The Chinese general public	$\alpha = .61$
Beliefs towards mental illness scale (BMI)	(Hirai & Clum, 2000)	21	Negative stereotypes against mental illness	The general public around the world	$\alpha = .81$ to $.92$ (Nohr et al., 2021)
Attitudes toward seeking professional psychological help scale (ATSPPHS-SF)	(Nohr et al., 2021)	10	Attitudes toward seeking professional psychological help	Adults in Germany and Cuba	Cuban ( $\alpha = .65$ ) German ( $\alpha = .79$ )
Self-Stigma of Seeking Help scale (SSOSH)	(Vogel et al., 2006)	10	Cognitive and emotional changes towards themselves in response to professional help-seeking	The American general public	$\alpha = .86$ to $.90$ ; test-retest = $.72$
Social Distance Scale (SDS)	(Burns et al., 2022)	7	Person's willingness to participate in varying degrees of proximity with people who have mental illness (Link, 1987)	Undergraduate journalism students attending a regional university in Australia	$\alpha = .90$
Multiple-Choice Knowledge of Mental Illnesses Test (MC-KOMIT)	(Compton et al., 2011)	33	Knowledge of mental illnesses	Officers in non-CIT and CIT classes from several jurisdictions in Georgia	The Pearson correlation coefficient was $0.79$

It can be seen that many unidimensional questionnaires have been developed for use, but most of these questionnaires are limited to the editors and their teams, and none of them have been widely adopted. The reason for this may be, on the one hand, that there are too many instruments measuring mental health literacy, and most of them have not been tested for external validity(O'Connor et al., 2014). So many researchers choose to design their own research tools that meet their research objectives. On the other hand, the content of the measurement varies depending on the researcher's purpose and bias, thus requiring the development of a questionnaire appropriate for the purpose of the team's research(Jiang et al., 2020).

#### 2.3.2.3 Multidimensional assessment tools

The Multidimensional Assessment Tool integrates multiple assessments of mental health literacy components of mental health literacy. The richness of these instruments also reflects the multidimensional nature of the concept of mental health literacy(Zhi-jun & Zhi-yan, 2020). Therefore, currently, relatively new research on individual mental health literacy would use these multidimensional mental health literacy questionnaires. The following are the more commonly used multidimensional mental health literacy assessment tools(see table 2-3):

Table 2-3 typical multiple dimensional assessment tools of mental health literacy

Questionnaire Name	Researchers and years	Number of items	Evaluation Content	Evaluation on Subjects	Reliability and validity
The Mental Health Literacy Scale (MHLS)	(O'Conno r et al., 2014)	35	Identification, knowledge, and attitudes	The general public	Internal consistency reliability of 0.87 and a retest reliability of 0.80
Multicomponent Mental Health Literacy Measure	(Jung, von Sternberg, & Davis, 2016)	26	Mental health knowledge, beliefs, and resources	Adult population	Internal consistency reliability was 0.83
The Mental Health Literacy questionnaire (MHLq)	(Dias, Campos, Almeida, & Palha, 2018)	29	Knowledge or prejudice about mental illness, help-seeking behavior and first aid skills, and self-help strategies	Adolescent contextual characteristics	Internal consistency reliability of 0.84
Mental Health Literacy Questionnaire (MHLQ)	(Smith et al., 2007)	78	Beliefs about values and abilities, beliefs about rights, knowledge and understanding, functional behaviors, critical behaviors, and communication behaviors	The general public	The internal consistency reliability was 0.95

National Mental Health Literacy Questionnaire (NMHLQ)	(Jue Wu et al., 2018)	60	Knowledge and perceptions of mental illness, attitudes towards mental illness and patients, coping with mental illness perceptions, behaviors and skills to cope with mental illness, knowledge and perceptions of mental health, and maintenance of mental health	The general Chinese public	The internal consistency reliability was 0.92, and the retest reliability was 0.72
The National Mental Health Literacy Questionnaire (TNMHLQ)	(Zhiyan, Yaxin, Guo, Jie, & Lan, 2019)	67	Knowledge, skills and awareness	The general Chinese public	Internal consistency reliability was 0.62-0.76
Mental Health Literacy Questionnaire (MHLQ)	(Jue Wu et al., 2022)	68	(1) mental health knowledge, (2) mental illness knowledge, (3) attitudes towards mental health, (4) attitudes towards mental illness, (5) behaviors regarding mental health promotion, and (6) behaviors regarding mental illness coping.	The general Chinese public	Cronbach $\alpha$ ranging from .68 to .80; KR20 = .76 and .74

In summary, multidimensional mental health literacy scales have been gradually enriched, and researchers have gradually advanced mental health literacy questionnaires toward universal applicability and localization. However, while pursuing the broad applicability of the questionnaire, researchers struggle to take into account the depth of specific populations; for example, it is difficult for them to conduct in-depth investigations of specific mental health problems encountered by university students. This study will combine previous research on mental health literacy with an in-depth investigation and discussion of the psychological problems that college students may suffer, and develop and revise a cross-culturally applicable mental health literacy multidimensional questionnaire for college students. Although a special in-depth investigation of the college student population would sacrifice the generality of the study, the college student population, as an important group in human society, can bring extraordinary significance to social and economic development by improving their mental health literacy and their mental health status.

### 2.3.3 As a moderator between perceived stress and rumination

So far, few research has directly found that mental health literacy has a moderating effect on perceived stress and rumination. However, mental health literacy may moderate the relationship between perceived stress and rumination in several ways. Individuals with higher levels of mental health literacy may be better able to recognize the negative effects of stress on their mental health and well-being and may be more likely to seek out appropriate resources and coping strategies. This may reduce the likelihood of engaging in rumination as a maladaptive coping mechanism.

Coping strategies are the actions and behaviors that individuals use to manage and reduce the effects of stress. Effective coping strategies can help individuals manage stress and prevent negative outcomes such as anxiety and depression.

Common coping strategies include problem-solving, social support seeking, distraction, and relaxation techniques. However, some coping strategies, such as rumination, can have negative effects on mental health (Kim & Duda, 2003). Rumination is a type of coping strategy that involves repeatedly thinking about the causes and consequences of one's stress. Rumination involves repetitive and passive thinking about a stressful event or situation and can lead to negative emotions and behaviors such as depression and anxiety. While some people may find it helpful to process their stress through reflection and introspection, excessive rumination can be harmful (Michl et al., 2013; Robinson & Alloy, 2003). Mental health literacy refers to an individual's knowledge and understanding of mental health issues, including the ability to recognize signs and symptoms of mental health problems, and to seek appropriate help and support. Research suggests that individuals with higher levels of mental health literacy are more likely to use problem-focused coping strategies, such as seeking social support or taking action to address the source of their stress, rather than relying on avoidant or maladaptive coping strategies, such as substance use or rumination (Aluh et al., 2018).

Based on the above evidence, it can be speculated that mental health literacy acts as a moderator between perceived stress and rumination, individual with higher level of MHL may show lower levels of rumination when facing with stress. Overall, mental health literacy can potentially act as a protective factor against rumination in the context of perceived stress.

#### 2.3.4 As a moderator between perceived stress and mobile phone addiction

Mental health literacy refers to an individual's knowledge and understanding of mental health issues, including the ability to recognize signs and symptoms of mental health problems, and to seek appropriate help and support. Individuals with higher



levels of mental health literacy are more likely to recognize the negative effects of mobile phone addiction on their mental health and well-being, and may be more likely to adopt effective coping strategies and seek help if needed(Jiang et al., 2020).

Perceived stress can lead to increased mobile phone use to cope with the stress. This is because mobile phones provide a convenient and immediate source of distraction and entertainment, which can provide temporary relief from stress(Peng-Fei et al., 2020). However, excessive and compulsive use of mobile phones can become a problem and interfere with daily life and functioning.

Research has shown that individuals with higher levels of mental health literacy may be better able to recognize the negative effects of mobile phone addiction, such as disrupted sleep patterns, decreased social connectedness, and increased feelings of anxiety and depression(Jeon et al., 2022). They may also be more likely to recognize the signs of addiction, such as feeling anxious or irritable when unable to use their phone and may be more likely to seek help to address these issues.

By improving mental health literacy, individuals can become more aware of the potential negative effects of mobile phone use and may be more likely to develop effective coping strategies to manage stress without relying on mobile phones(Fraser & Pakenham, 2009). They may also be more likely to recognize the signs of addiction and seek help if needed.

Furthermore, mental health literacy can help individuals recognize the potential negative effects of mobile phone use on their mental health and well-being. Excessive mobile phone use can lead to decreased social connectedness, disrupted sleep patterns, and increased feelings of anxiety and depression(Gao et al., 2018). By recognizing these potential negative effects, individuals with higher levels of mental health

literacy may be more likely to take steps to reduce their mobile phone use and improve their mental health and well-being.

Overall, mental health literacy can potentially act as a protective factor against mobile phone addiction in the context of perceived stress. By promoting mental health literacy, individuals can become more equipped to manage stress and avoid developing problematic mobile phone use.

### 2.3.5 As a moderator between rumination and mobile phone addiction

One factor that may contribute to the development of mobile phone addiction is rumination, a process characterized by repetitive and uncontrollable negative thinking(Lian et al., 2021). Mental health literacy, or knowledge and understanding of mental health, may moderate the relationship between rumination and mobile phone addiction.

Rumination is a common process that occurs in response to negative life events or stressors, and it involves repetitively dwelling on negative thoughts, feelings, and experiences(Michl et al., 2013). Individuals who ruminate excessively are at increased risk for developing a range of mental health problems, including depression, anxiety, and substance abuse(Robinson & Alloy, 2003). Rumination has also been linked to problematic mobile phone use, with individuals who engage in high levels of rumination being more likely to experience mobile phone addiction symptoms(Lian et al., 2021).

Mobile phone addiction, also known as problematic mobile phone use or smartphone addiction, is characterized by excessive use of mobile phones, loss of control over use, and negative consequences such as impaired academic or work

performance, social isolation, and psychological distress(Ibrahim et al., 2018; Ma et al., 2021). The prevalence of mobile phone addiction is high, with estimates ranging from 10% to 30% of the college students(Mei et al., 2022; Soni et al., 2017).

Mental health literacy refers to the knowledge and understanding of mental health, including the ability to recognize and manage mental health problems. Mental health literacy has been shown to be an important factor in promoting mental health and reducing the negative consequences associated with mental health problems(Jorm, 2012).

Specifically, individuals with high levels of mental health literacy may be better able to recognize the negative consequences of excessive mobile phone use and may be more motivated to engage in behaviors that promote mental health and reduce mobile phone use(Burns & Rapee, 2006; Reavley & Jorm, 2011).

There is some empirical evidence to support the moderating role of mental health literacy in the relationship between rumination and mobile phone addiction. For example, one study found that mental health literacy was negatively associated with mobile phone addiction symptoms, indicating that individuals with higher levels of mental health literacy were less likely to experience problematic mobile phone use(Jeon et al., 2022).

In conclusion, rumination is a risk factor for mobile phone addiction, and mental health literacy may moderate the relationship between these two constructs. Individuals with high levels of mental health literacy may be better able to recognize the negative consequences of excessive mobile phone use when in the context of rumination and may be more motivated to engage in behaviors that promote mental health and reduce mobile phone use.

## 2.4 Mobile phone addiction

### 2.4.1 Definition

Mobile phone addiction refers to the excessive and compulsive use of mobile devices, such as smartphones and tablets, to the extent that it interferes with daily life activities, relationships, work or school performance, and mental health (Park, 2005).

The concept of mobile phone addiction emerged in the early 2000s with the widespread availability and usage of mobile devices. It became a concern as people started to rely on their mobile phones not only for communication but also for entertainment, information, social interaction, and other activities that can be accessed through mobile apps and the internet (Park, 2005).

While mobile phone addiction is not officially recognized as a diagnosable disorder in many psychiatric manuals, such as the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), some researchers and clinicians propose its inclusion under the umbrella of behavioral addictions. In these proposals, criteria often parallel those for substance abuse disorders, such as withdrawal symptoms, increasing tolerance, and negative impact on daily functioning (Grant et al., 2010).

From a psychological perspective, mobile phone addiction has been examined through various lenses:

(1) Behavioral Addiction Models: These models propose that mobile phone addiction shares characteristics with other behavioral addictions like gambling, such as compulsive use and preoccupation with the activity (Griffiths, 1996).

(2) Cognitive-Behavioral Models: Some theories focus on the cognitive aspects, suggesting that addictive behaviors may stem from faulty beliefs and cognitive biases (Davis, 2001).

(3) Attachment Theory: There is also literature suggesting that mobile phone addiction could be understood through the lens of attachment theory, where the device serves as a "secure base" in a digitally interconnected world (Konok et al., 2016).

Various scales and measures have been developed to evaluate mobile phone addiction, each focusing on different dimensions:

(1) Compulsive Behavior. One of the most widely recognized features of mobile phone addiction is compulsive behavior, manifesting as an irresistible urge to constantly check one's phone. Studies have shown that such compulsive behaviors can interfere with daily tasks, leading to reduced productivity and increased stress (Billieux et al., 2015).

(2) Tolerance. Similar to substance addiction, tolerance in mobile phone addiction describes the need for extended use to achieve the same level of satisfaction or relief. Over time, individuals may find that they need to spend increasing amounts of time on their mobile device to derive the same "high" they initially experienced (Andreassen et al., 2016).

(3) Withdrawal Symptoms. Withdrawal symptoms are another key component, characterized by emotional or physical discomfort when the individual is unable to use their phone. Symptoms can range from irritability and restlessness to anxiety and even panic attacks in extreme cases (Chóliz, 2010).

(4) Neglect of Other Activities. Another important dimension is the neglect of other life activities in favor of mobile phone use. Excessive use of mobile phones often comes at the expense of other social, occupational, or recreational activities. It's not uncommon for people with mobile phone addiction to withdraw from social circles, miss deadlines, or underperform in academic or occupational settings

(Demirci et al., 2015).

(5) Cognitive Disruptions. Some scales and studies also examine the cognitive disruptions caused by mobile phone addiction. For instance, multitasking, diminished attention span, and reduced memory capacity have all been observed among those who excessively use their mobile devices (Rosen et al., 2013).

(6) Emotional Dependence. There is a growing body of research focusing on the emotional dependence associated with mobile phone addiction. People often resort to their phones for emotional support and validation, leading to a dysfunctional coping strategy that reinforces addictive behavior (Elhai et al., 2017).

Some studies suggest that mobile phone addiction is a real and serious problem that can lead to negative outcomes such as anxiety, depression, sleep disturbance, poor academic or work performance, and social isolation (Ibrahim et al., 2018; Peng-Fei et al., 2020). Other studies argue that mobile phone use is a normal and adaptive behavior that can enhance communication, productivity, and well-being, and that the negative effects of mobile phone use are overstated or only affect a small subset of users (Chan, 2015).

One of the most intriguing avenues of research in the context of mobile phone addiction is its relationship with psychological constructs like perceived stress. A growing body of research has indicated a strong positive correlation between mobile phone addiction and levels of perceived stress (Thomée et al., 2011). For example, frequent checking of notifications and social media feeds can create a state of hyper-vigilance that contributes to heightened stress levels (Lin et al., 2014). Several mechanisms have been proposed to explain this correlation. One argument suggests that the compulsive need to stay connected and the constant influx of information

contributes to an overload, consequently elevating stress levels (Luxton et al., 2011). There's also evidence to suggest a bidirectional relationship, where high levels of stress may lead individuals to use their mobile phones excessively as a coping mechanism, thereby entering a vicious cycle of increased stress and addiction (Chiu, 2014).

Increasingly, research is focusing on how this form of behavioral addiction intersects with other psychological states, particularly perceived stress, and rumination. Recent studies have begun to explore the possibility that rumination acts as a mediating factor between mobile phone addiction and perceived stress. In these models, stress leads to increased ruminative thoughts, which then contribute to addictive behavior (Elhai et al., 2018). Mobile phones can serve as a convenient escape from uncomfortable ruminative thoughts. However, this form of escapism often serves to reinforce the ruminative cycle by preventing effective problem-solving or cognitive restructuring (Moberly & Watkins, 2008). Furthermore, the act of ruminating can also lead to a preoccupation with potential stressors that may be encountered online (e.g., social comparisons, fear of missing out), thereby exacerbating both rumination and the compulsion to check one's phone (Smith et al., 2019). The literature often demonstrates that perceived stress, rumination, and mobile phone addiction frequently co-occur, leading to a complicated web of interlinked psychological processes (Peng et al., 2022). While the evidence strongly supports correlations, causality remains an open question. Longitudinal studies are needed to better understand the directionality of these relationships (Elhai et al., 2020).

Overall, mobile phone addiction is closely intertwined with perceived stress and rumination. While the causal relationships between these psychological states are not yet definitively established, their co-occurrence and potential to amplify each other

have significant implications for mental health and well-being. Understanding these relationships can inform interventions that address the multi-faceted nature of mobile phone addiction and its psychological correlates.

#### 2.4.2 Measurement

The current assessment and measurement of mobile phone dependence is mainly based on self-report questionnaires. Table 2-4 shows some questionnaires measuring mobile phone dependence behaviors. These questionnaires have been tested for standardized reliability, and they differ significantly due to the theoretical basis of questionnaire development, research purpose and research content.



Table 2 Summary of mobile phone dependence behavior measurement tools

Scale name	Scale source	Objects	Items	Factors	Reliability
Mobile Phone Problem Usage Scale (MPPUS)	(Bianchi & Phillips, 2005)	College students and community groups	28 items, 10-point scale	Single dimension	$\alpha=.93$
Problematic Mobile Usage Scale(PMPUS)	(Billieux et al., 2008)	Community groups	30 items, 4-point scale	Dangerous use, controlled dependence, economic problems	$\alpha=.74$ (dangerous use), $\alpha=.89$ (economic problems), $\alpha=.67$ (controlled use), $\alpha=.85$ (dependence)
Mobile Phone Dependence Questionnaire (MPDQ)	(Toda et al., 2004)	Female college students	20 items, 4-point scale	Single dimension	$\alpha=.86$
Text Messages Dependency Scale (TMDS)	(Igarashi et al., 2008)	College students	15 items, 5-point scale	Emotional interaction, overuse, relationship maintenance	$\alpha=.81$ (emotional interaction), $\alpha=.85$ (overuse), $\alpha=.78$ (relationship maintenance)
SMS- problematic Use Diagnostic Scale (PUDQ)	(Rutland et al., 2007)	College students	8 items, 2-point scale	Pathological overuse	$\alpha=.84$ (pathological use), $\alpha=.87$ (overuse)
Mobile Phone Involvement Questionnaire (MPIQ)	(Walsh et al., 2010)	College students and community groups	8 items, 7-point scale	Single dimension	$\alpha=.80$

Scale name	Scale source	Objects	Items	Factors	Reliability
Smartphone Addiction Scale (SAS)	(Kwon, Lee, et al., 2013)	College students and community groups	32 items, 6-point scale	Daily-life disturbance, Positive anticipation, Withdrawal, Cyberspace-oriented relationship, Overuse, Tolerance	$\alpha=.858$ (daily-life disturbance) , $\alpha=.913$ (positive anticipation) , $\alpha=.876$ (withdrawal) , $\alpha=.904$ (cyberspace-oriented relationship) , $\alpha=.825$ (overuse) , $\alpha=.865$ (tolerance)
Mobile Phone Addiction Type Scale (MPATS)	(Q.-Q. Liu et al., 2022)	Adolescents and Young Adults	26 items, 5-point scale	Mobile social networking addiction , Mobile game addiction, Mobile information acquisition addiction, Mobile short-form video addiction	$\alpha=.869$ (mobile social networking addiction), $\alpha=.860$ (mobile game addiction), $\alpha=.919$ (mobile information acquisition addiction), $\alpha=.898$ (mobile short-form video addiction)

### 2.4.3 The impact of mobile phone addiction on college students' academic achievement

Many studies have shown that mobile phone addiction will have a negative impact on college students' academic achievement, and there are many paths that cause this negative impact.

Firstly, mobile phone addiction affects the students' ability to concentrate and focus on their studies. The constant notifications and alerts from social media, messaging apps, and other applications distract students from their studies(Lian et al., 2022). This leads to a decrease in their attention span and inability to concentrate on

their coursework, resulting in poor academic achievement.

Secondly, mobile phone addiction has affected students' sleep patterns, leading to a lack of sleep and tiredness. Many students spend a significant amount of time on their phones, leading to them staying up late at night. This lack of sleep leads to students feeling tired and unable to concentrate in class, which ultimately affects their academic achievement(Ibrahim et al., 2018; Q. Liu et al., 2017).

Thirdly, mobile phone addiction leads to poor time management. Students may spend hours scrolling through social media platforms, messaging friends, or playing games on their phones, leading to them neglecting their studies. This results in students not completing assignments on time, not studying for exams, and not attending classes, ultimately leading to poor academic achievement(Chen et al., 2021).

Fourthly, mobile phone addiction leads to a decrease in students' critical thinking and problem-solving skills. With easy access to information on the internet, students have become accustomed to relying on their phones for answers, leading to a lack of critical thinking and problem-solving skills. This, in turn, affects their academic achievement, as they are unable to solve complex problems in class or during exams(Thomas, 2020). On the other hand, some social media, such as TikTok's algorithmic nature and short-form content can promote passive consumption rather than active engagement and critical analysis of information.

Fifthly, mobile phone addiction has led to a decrease in face-to-face interactions among students. Students spend most of their time on their phones, communicating with friends and family members, leading to a decrease in face-to-face interactions. This has affected their communication and interpersonal skills, which are essential for academic success(David & Roberts, 2017).

Finally, mobile phone addiction has affected students' mental health, leading to stress, anxiety, and depression. With the constant pressure to keep up with their social media profiles and the fear of missing out, students become stressed and anxious, affecting their mental well-being. This, in turn, affects their academic achievement, as they are unable to focus on their studies due to the mental stress they are experiencing (Gao et al., 2018; Shoukat, 2019).

In conclusion, mobile phone addiction has had a severe impact on college students' academic achievements. It has affected their concentration, sleep patterns, time management, critical thinking and problem-solving skills, communication, interpersonal skills, and mental health. To combat this issue, colleges and universities must take steps to educate students about the negative effects of mobile phone addiction and provide support to those who are struggling. Additionally, students should be encouraged to practice healthy phone habits, such as setting boundaries and limiting screen time, to improve their academic performance and overall well-being.

## 2.5 Academic achievement

### 2.4.1 Definition

Academic achievement is regarded as a standard for measuring students' knowledge level and adapting to schools and is an effective indicator for quantitatively evaluating the effectiveness of national education. It has become a core word of concern for students, parents, schools and society. Good academic achievement is not only conducive to the realization of a virtuous circle in the process of individual development, but also an important factor in eliminating the intergenerational transmission of poverty (Guoxia & Yang, 2022), so it is of great significance to analyze the influencing factors of academic achievement.

Research on academic achievement has a long history and has been conducted across multiple disciplines, including psychology, education, sociology, and economics. In the early 20th century, the focus of research on academic achievement was primarily on individual differences in intelligence and the impact of environmental factors on academic performance(Cassidy, 2012; Gilavand, 2016). During this time, researchers such as Alfred Binet and Lewis Terman developed intelligence tests to measure cognitive abilities and predict academic achievement(Wasserman, 2018).

In the 1960s and 1970s, the focus of research on academic achievement shifted towards identifying the factors that contribute to academic success, including individual characteristics such as motivation and self-regulation, as well as environmental factors such as family background, socio-economic status, and school quality. This research helped to highlight the importance of addressing broader societal issues, such as poverty and inequality, in promoting academic achievement(Steinmayr et al., 2014).

In recent years, research on academic achievement has increasingly focused on identifying effective interventions and strategies to support student learning and improve academic outcomes. This includes interventions such as tutoring, mentoring, and educational programs, as well as the use of technology to enhance learning and provide personalized support to students.

Overall, research on academic achievement has played an important role in informing educational policies and practices and promoting educational equity and excellence.

### 2.4.2 Measurement

Researchers have tried to use many ways to evaluate students' academic achievement in order to measure the degree of students' academic success. At that time, the focus of research was primarily on measuring intelligence, and researchers such as Alfred Binet and Lewis Terman developed intelligence tests to predict academic achievement in 1895(Binet & Henri, 1895). However, this approach was criticized for being too narrow and not capturing the full range of factors that contribute to academic success.

In the 1960s and 1970s, research on academic achievement assessment began to shift towards a more comprehensive and holistic approach. This involved developing new assessment tools and techniques that could capture a wider range of cognitive, affective, and behavioral factors. For example, researchers began to develop performance assessments, which involve having students demonstrate their knowledge and skills through a task or activity(Heck et al., 1990; Vogt et al., 1987). These assessments were seen as more authentic and relevant to real-world contexts than traditional standardized tests.

In the 1980s and 1990s, there was a growing interest in using technology to enhance academic achievement assessment. This led to the development of computer-based assessments(Bocij & Greasley, 1995), which allowed for greater flexibility and customization in assessment design and administration. Researchers also began to explore the use of adaptive testing, which involves adjusting the difficulty level of test items based on the student's previous responses(Weiss & Kingsbury, 1984).

More recently, research on academic achievement assessment has focused on improving the validity and reliability of assessments, as well as ensuring that they are fair and equitable for all students(Cizek, 2009). For example, researchers have

explored the use of alternative assessment formats, such as project-based assessments or open-ended questions, to reduce the impact of test-taking skills and cultural biases(Dori, 2003). They have also developed new statistical methods for analyzing assessment data, such as item response theory and multidimensional scaling.

In addition, research has highlighted the importance of using assessments to support student learning and growth, rather than simply as a tool for evaluation or accountability(Gibbs, 2010). This has led to the development of formative assessment practices, which involve providing students with ongoing feedback and support to help them improve their academic achievement over time.

There are several assessment tools that can be used to measure academic achievement. Some common examples include:

**Standardized tests:** These are tests that are administered under standardized conditions and scored using standardized procedures. Examples include the SAT, ACT, and various state achievement tests.

**Grades:** Grades are a common measure of academic achievement and are typically based on a combination of tests, assignments, and other assessments.

**Portfolios:** A portfolio is a collection of work samples that demonstrate a student's skills and knowledge in a particular subject or area. Portfolios can be used to assess a student's academic achievement over time.

**Performance assessments:** Performance assessments involve having students demonstrate their skills or knowledge in a particular area through a task or activity. Examples include science experiments, essays, or oral presentations.

**Teacher evaluations:** Teacher evaluations involve having teachers assess students'

knowledge and skills in a particular area based on their observations, interactions, and assessments.

In addition, there are many different questionnaires that can be used to assess college students' academic achievement, each with its own specification and limitations. Here are some examples:

(1) Academic Motivation Scale (AMS): The AMS is a 28-item questionnaire developed by Vallerand et al. in 1992, which measures college students' motivation for academic achievement across 3 different domains, intrinsic motivation, extrinsic motivation, and amotivation. Each item on the AMS is rated on a seven-point Likert scale, ranging from 1 (does not correspond at all) to 7 (corresponds exactly)(Vallerand et al., 1992). Reliability refers to the consistency of scores obtained from a measure. The internal consistency reliability of the AMS has been found to be high, with Cronbach's alpha coefficients ranging from .70 to .92 for the three motivation types (intrinsic, extrinsic, and amotivation), and .87 for the overall academic motivation score.

Overall, there are many assessment tools available to measure academic achievement, and each has its own strengths and limitations. The choice of assessment tool will depend on the specific goals and objectives of the assessment, as well as the context in which it is being used.

### 2.4.3 Influencing Factors of Academic Achievement

Academic achievement is influenced by various factors, both internal and external to the individual. For example, students' cognitive abilities, such as intelligence, memory, and attention, play a significant role in their academic success(Petrill & Wilkerson, 2000; Polderman et al., 2010). Students with high



cognitive abilities tend to perform better in academic tasks and achieve higher grades than those with lower cognitive abilities. However, cognitive abilities are not the only determinant of academic achievement, and other factors, such as motivation, self-regulation, and self-efficacy, are also critical(Rohde & Thompson, 2007).

In addition to the factors mentioned earlier, academic achievement may also be affected by perceived stress, rumination, and mobile phone addiction. Perceived stress refers to the subjective appraisal of the degree to which situations in one's life are perceived as stressful(Peng et al., 2022). Perceived stress can result from various sources, including academic demands, personal relationships, financial difficulties, and health problems(Kessler et al., 1985). When students perceive their academic workload as stressful, they may experience negative emotions, such as anxiety, worry, and frustration, which can interfere with their cognitive processes and academic performance(Firth et al., 2019). High levels of perceived stress have been linked to lower academic achievement, lower self-esteem, and poorer mental and physical health(Rücker, 2012).

Rumination can prolong the experience of stress and worsen its impact on mental health and academic performance(Flett et al., 2016). Students who engage in rumination may find it challenging to focus on academic tasks, remember information, and generate creative ideas(Lyubomirsky et al., 2003). Rumination may be linked to lower academic achievement.

Mobile phone addiction is characterized by excessive and compulsive use of mobile phones, leading to negative consequences, such as social isolation, reduced productivity, and impaired mental and physical health. Students who are addicted to their mobile phones may be distracted from their academic work, procrastinate, and have trouble concentrating(Shi et al., 2021). Mobile phone addiction has been linked

to lower academic achievement and poorer mental health(Goswami & Singh, 2016).

Mental health literacy can act as a protective factor by helping students to recognize and manage stress, challenge negative thoughts and emotions, and seek support when needed(Jiang et al., 2020). When students have high levels of mental health literacy, they may be more resilient to the negative effects of stress, rumination, and mobile phone addiction, and better able to maintain their academic performance(Slewa-Younan et al., 2014). For example, students who have high mental health literacy may be more likely to seek help from mental health professionals, such as counselors, to manage their stress and negative emotions(Wei et al., 2015). They may also be more likely to use effective coping strategies, such as mindfulness, relaxation techniques, and exercise, to reduce stress and improve mental health(Fraser & Pakenham, 2009).

In conclusion, academic achievement is a complex and multidimensional construct that can be influenced by various internal and external factors, including perceived stress, rumination, and mobile phone addiction, then mental health literacy may be a protective factor for academic achievement. This study aims to examine the relationships among these variables and to develop a mediation and moderation model to better understand how they interact and affect academic achievement. Understanding these relationships can inform the development of interventions and strategies to support students' academic success and well-being.

## 2.6 Research Gap

Through the above literature review, it can be found that perceived stress, rumination, mental health literacy, mobile phone addiction and academic achievement have all developed significantly. However, there are still some gaps in these studies.

(1) The Cross-cultural Gap: Studies on psychological variables often factor in cultural nuances, given that individual and societal responses can differ substantially between regions. Research on perceived stress, rumination, and mobile phone addiction, among other factors, has predominantly been conducted within specific cultural settings, either in the West or the East. However, the comparative analysis between two geographically and culturally diverse regions like the Czech Republic (representing Central Europe) and China (representing East Asia) might be limited. This comparative approach is vital as it can offer insights into whether certain phenomena are universally applicable or contingent on cultural factors. With globalization, understanding these cross-cultural nuances becomes pivotal, especially for educational institutions that cater to diverse student populations.

(2) Nuanced Chain Mediation Models: The contemporary academic landscape acknowledges that issues like academic achievement are multifactorial. However, literature might not always capture the intricate web of these factors and their interplay. The combined mediation effects of both rumination and mobile phone addiction, particularly in the relationship between perceived stress and academic achievement, might be an area not deeply probed. Dissecting these chained mediatory roles can unravel the sequential impact of stressors on outcomes like academic performance.

(3) The protective role of mental health literacy: Mental health literacy, while recognized as an essential facet of well-being, might not have been exhaustively studied as a moderator in the aforementioned relationships. Its role as a buffer or protective factor, especially in the chain mediation model you propose, can be a critical area of exploration. Given the rising global emphasis on mental health, understanding how mental health literacy can mitigate negative outcomes becomes

paramount.

(4) **The Evolving Dimension of Mobile Phone Addiction:** Mobile technology, and our relationship with it, has rapidly evolved over the last few decades. While initial studies might have focused on basic mobile phone usage, the surge of smartphones, social media, and digital platforms may have reshaped this dynamic. Therefore, understanding mobile phone addiction in today's context, especially its implications on academic contexts, can be a novel area. Furthermore, its mediation role between rumination and academic achievement might be a relatively uncharted domain.

(5) **Comprehensive Synergistic Impacts:** Each factor—perceived stress, rumination, mobile phone addiction, and mental health literacy—might have been individually studied concerning academic achievement. However, the synergistic or combined effects of all these elements on academic outcomes might be an area that previous research hasn't holistically covered. This integrative approach could provide more detailed insights and offer a fuller picture of the complexities surrounding academic achievement.

(6) **Geographical and Demographical Specifics:** Research sometimes overlooks the granular differences that specific regions or demographics might present. For instance, college students in regions like Sichuan might face unique stressors or cultural expectations that aren't generalized in broader studies. Addressing such specifics can lead to more tailored interventions and a better understanding of localized experiences.

(7) **The impact of COVID-19:** While the aforementioned threads of research on perceived stress, rumination, mobile phone addiction, and academic achievement have

seen substantial development, the onset of the COVID-19 pandemic introduced a paradigm shift in global behavioral patterns. This unprecedented event and the subsequent lockdowns radically altered daily routines, social interactions, and modes of communication and learning. During the COVID-19 epidemic lockdown, individuals across the globe found themselves confined to their homes, with face-to-face social interactions drastically reduced. This confinement invariably led to an increased reliance on digital platforms for both professional and personal purposes. For students, this meant a sudden and complete shift to online learning, virtual group studies, and digital leisure activities. Initial studies during this period indicated a potential surge in screen time and, consequently, a possible increase in mobile phone addiction levels. Yet, the comprehensive impact of this enforced digital immersion, particularly among Chinese students, remains an underexplored domain.

Equally intriguing is the aftermath of such intense digital reliance. Did mobile phone addiction levels recede to pre-pandemic norms after the lockdown was lifted? Or did the habits and dependencies formed during lockdown sustain, indicating a lasting behavioral change? The comparative study of mobile phone addiction levels during and after the epidemic lockdown can offer invaluable insights into the temporal effects of global crises on behavioral patterns.

Given that perceived stress, rumination, and academic achievement are core themes of this research, it becomes crucial to understand how the temporal variations in mobile phone addiction, as influenced by the COVID-19 lockdown phases, interact with these variables. For instance, did the increased mobile phone usage during lockdown amplify perceived stress and rumination, subsequently affecting academic achievement? And did these patterns see a shift post-lockdown?

## 3 Research Design

### 3.1 Participants

To obtain a comprehensive understanding of the relationship between perceived stress, rumination, mobile phone addiction, academic achievement, and the potential protective role of mental health literacy, our research implemented a cross-cultural and temporal approach in its sample selection. The specific details of the sample selection are as follows: The participants in this study will be college students from a university in Sichuan, China, and a university in Czech Republic. The inclusion criteria for participants are being currently enrolled as a student in a college or university and being over 18 years old. Participants who are not currently enrolled as full-time students or are under 18 years old will be excluded from the study.

The sampling strategy will be a convenient sampling method, which involves selecting participants who are easily accessible and willing to participate in the study. Participants will be recruited through various channels, including university bulletin boards, social media, and email lists. To ensure that the sample is representative of the student population in each country, the sample will be stratified based on gender and academic major.

To discern the potential impact of time, especially in the context of the ongoing global changes and challenges, samples were collected in two distinct time periods:

March to May 2022: This phase of data collection allowed us to gather insights during a period where the residual impacts of the COVID-19 pandemic and lockdowns were still prominent. Both the Chinese and Czech student communities faced unique challenges and adjustments during this period, making it a crucial timeframe for the study.

March to May 2023: Exactly a year later, another round of data collection was conducted. This temporal gap offered an opportunity to observe any shifts or evolutions in the variables under study, especially as the world continued to adjust to post-pandemic norms.

To calculate the required sample size, a power analysis will be conducted using G\*Power software. The effect size of the model will be estimated based on the results of previous studies that have examined the relationships among perceived stress, rumination, mobile phone addiction, mental health literacy, and academic achievement. The level of significance will be set at 0.05, and the power will be set at 0.80.

Assuming a medium effect size, the required sample size will be approximately 200 participants from each country, for a total sample size of 400 participants. To account for potential dropouts or missing data, the sample size will be increased by 10%. Therefore, a final sample size of 440 participants (220 from Sichuan, China, and 220 from the Czech Republic) will be recruited for this study.

### 3.2 Measurements

(1) The Perceived Stress Scale (PSS), developed by Sheldon Cohen, Kamarck, & Mermelstein (1994), was employed to gauge participants' perceived stress. This 10-item scale utilizes a 5-point scoring system, where 1 denotes "never" and 5 indicates "always." Scores can range from 10 to 50, with a higher score signifying greater perceived stress (Cohen et al., 1994). Previous research underscores the instrument's reliability for Chinese student populations (Deng et al., 2020; Lu et al., 2017), yielding an internal consistency coefficient of 0.84 in this study. For our Czech sample, we utilized the revised version of the PSS by N Figalová (2021). This version has demonstrated robust internal consistency with a Cronbach's  $\alpha$  of 0.91 and a

McDonald's  $\omega$  of 0.90. Furthermore, its structural validity is validated by multiple metrics:  $\chi^2(35) = 1880.828$ , SRMR = 0.070, RMSEA = 0.175, NFI = 0.915, TLI = 0.893, CFI = 0.916, and IFI = 0.914 (Figalová & Charvát, 2021).

(2) The Ruminative Responses Scale: Developed by Susan Nolen-Hoeksema in 1991, this scale delves into three key dimensions of rumination: symptom rumination, brooding, and reflective pondering. Comprising 22 items, respondents indicate their agreement using a four-point scale, ranging from 1 (never) to 4 (always). A higher score denotes a more pronounced inclination towards a ruminative thought process (Nolen-Hoeksema, 1991). Studies, such as that by Y. Li et al. (2019), validate its applicability to Chinese student populations. The scale exhibits commendable reliability, with subscale  $\alpha$ -values equating to 0.84 (Li et al., 2019).

(3) The Short Version of the Smartphone Addiction Scale (SAS-SV) was used (Kwon, Kim, et al., 2013). The scale consists of 10 items rated on a six-point scale (1 = totally disagree, 6 = totally agree), with higher scores indicating a higher level of mobile phone addiction. The cronbach's  $\alpha$  was 0.76. A study by De Pasquale, Sciacca, and Hichy (2017) validated the Italian version of the SAS-SV, finding good psychometric properties ( $\alpha = 0.79$ ) (De Pasquale et al., 2017). Lopez-Fernandez et al. (2017) adapted the SAS-SV for use in European countries, including Spain and France, examining its psychometric properties and finding it to be a reliable tool (root mean square error of approximation, comparative fit index, Tucker–Lewis index: structural validity – minimum  $RMSEA_{\text{English}} = .05$  and maximum  $RMSEA_{\text{Italian}} = .1$ ; maximum  $CFI_{\text{German}} = .92$  and  $TLI_{\text{German}} = .91$ , and minimum  $CFI_{\text{Polish}} = .74$  and  $TLI_{\text{Polish}} = .69$ ,  $\alpha = 0.91$ ) (Lopez-Fernandez et al., 2017).

(4) Mental Health Literacy Scale modified by Han et al. (2019) from Mental Health Literacy Scale (MHLS) developed by O'Connor et al. (Han et al., 2019;



O'Connor & Casey, 2015), it's a total of 35 items, divided as follows: Knowledge (15 items), understanding of where to find information (4 items), and attitudes conducive to recognizing and seeking appropriate assistance (16 items), using a 5-point assessment (with a range of 35-155 points, with higher scores reflecting better mental health literacy). Since item 34 of the original questionnaire "How willing would you be to vote for a politician if you knew they had suffered a mental illness?" is not consistent with China's social conditions, it was deleted. This is consistent with the study of Han et al. (2019) The same approach was adopted. Among them, item 10, 12, 15, 20-28 are reverse scored items. To make both subjects test the same content, this item was also deleted among the Czech subjects. The internal consistency reliability of knowledge was 0.718, and the internal consistency reliability of ability to acquire information was 0.70, and  $\alpha(\text{attitude}) = 0.852$ .

(5) The Academic Achievement Questionnaire (AAQ) is a 9-item questionnaire designed to measure academic achievement. The questionnaire includes three subscales: study performance, coping with study requirements, and social adaptation. The items are rated on 6-point Likert scale. The first subscale is calculated as a weighted mean of ECTS grades, while the remaining subscales are calculated as mean response values (Křeménková & Novotný, 2020). The reliability of the questionnaire subscales equals  $\omega = .798, .804, \text{ and } .645$ . The first four items of the questionnaire are study performance subscales, and the items are: "1. What is your average (most common) exam mark during university study?", "2. What is your average (most common) exam mark in the last semester?", "3. What was your best exam mark in the last semester?", and "4. What was your worst exam mark in the last semester?" Due to the different scoring methods of Czech college students and Chinese college students, options 1-6 in the original Czech version of the questionnaire were academic grades

A-F respectively. These options were changed to "1. 45 points or less", "2. 46-60 points", "3. 61-70 points", "4. 71-80 points", "5. 81-90 points" and "6. 90 points or above" in the Chinese version. In this way, the higher the item number of the option, the better the study performance, so this study will conduct reverse scoring on these four items for Czech college students.

### 3.3 Data analysis

The analysis will be conducted in several steps, as outlined below:

#### Step 1: Descriptive Statistics and Correlations

Descriptive statistics and correlations are fundamental statistical tools used in research to summarize data and to examine the relationships between variables, respectively. Both are essential in psychological research and serve as a preliminary step before conducting more complex analyses, like regression or mediation models.

Descriptive statistics involve numerically summarizing and organizing the information collected in a study. This includes measures of central tendency (mean, median, and mode) and measures of variability (standard deviation, variance, range, and interquartile range). Descriptive statistics give a quick overview of the data and can help researchers understand the distribution and central values of their variables. For example, the mean gives an average score, while the standard deviation provides insight into the spread of scores around this average. In educational psychology, for instance, the work of Hattie (2009) illustrates the importance of descriptive statistics. In his meta-analysis, Hattie used the mean effect size to describe the average impact of various educational interventions, providing a powerful summary of educational research (Hattie, 2009).

Correlation is a statistical measure that describes the size and direction of a

relationship between two variables. It is often measured by the correlation coefficient (Pearson's  $r$ ), which ranges from -1 to +1, with -1 indicating a perfect negative correlation, +1 indicating a perfect positive correlation, and 0 indicating no correlation.

Correlation analyses help researchers understand whether and how strongly pairs of variables are related. This is crucial for identifying potential predictors of outcomes of interest, relationships between different psychological constructs, and for informing subsequent analyses. In the study of educational psychology, correlations are frequently used to explore relationships between students' psychological traits and their learning outcomes. For example, Steinmayr, Crede, McElvany, and Wirthwein (2016) examined the correlation between academic self-efficacy and school achievement, finding a moderate to strong positive correlation (Steinmayr et al., 2016). This indicates that students who perceive their academic capabilities more positively tend to perform better academically.

When reporting descriptive statistics and correlations, it's important to adhere to reporting standards such as those suggested by the American Psychological Association (APA), which advocates for clarity, precision, and transparency in the presentation of statistical results. For example, APA style would require reporting the mean and standard deviation for each variable, as well as the Pearson correlation coefficients for the relationships between variables.

Lastly, while correlations are insightful, it's important to remember that they do not imply causation. High correlations between two variables do not necessarily mean that one variable causes the other to occur; they only suggest a relationship that may be explored further using experimental or longitudinal designs.

When conducting research in educational psychology, utilizing descriptive statistics and correlations responsibly can provide a strong foundation for understanding the data and setting the stage for more complex analyses.

Step 2: Comparison of perceived stress, rumination, cell phone addiction, and mental health literacy on demographic variables

This step is crucial because it allows researchers to understand how different demographic factors, such as country of origin or gender, might influence the psychological constructs under study. SPSS 22.0, a statistical software package, can be used to perform these comparisons.

The independent samples t-test is a statistical procedure used to determine whether there is a significant difference between the means of two independent groups on a continuous dependent variable. When comparing perceived stress, rumination, mobile phone addiction, and mental health literacy based on demographic variables like country and gender, the independent samples t-test can provide insights into the impact of these demographics on the variables of interest. An example from the literature is a study by Steptoe, O'Donnell, Marmot, and Wardle (2008), who used independent samples t-tests to compare levels of perceived stress between genders in a sample of British civil servants (Steptoe et al., 2008). This type of analysis is critical for identifying demographic groups that may be at higher risk for certain psychological outcomes.

The Wilcoxon Rank Sum test, also known as the Mann-Whitney U test, is a non-parametric test used to compare differences between two independent groups when the dependent variable is not normally distributed or when the sample sizes are small. In situations where the sample sizes for certain demographic categories (like parental

education levels) are small or the data do not meet the assumptions of the t-test (like normality), the Wilcoxon Rank Sum test is appropriate. This test ranks all the data points and compares the sums of these ranks between groups. A study by Piko and Hamvai (2010) utilized the Mann-Whitney U test to compare the health behaviors of two groups of adolescents with different educational backgrounds (Piko & Hamvai, 2010). This kind of analysis helps in understanding how parental education may affect psychological constructs without the need for large samples.

### Step 3: Testing for Moderated Mediation

The analysis of moderated mediation is critical for understanding complex relationships among variables in psychological research. The PROCESS macro for SPSS, created by Hayes (2013), facilitates such analyses by allowing researchers to test for indirect effects of an independent variable on a dependent variable through a mediator, and how these effects may vary at different levels of a moderator (Hayes & Scharkow, 2013). This approach is particularly relevant when the theoretical model suggests that the pathway from the independent variable to the dependent variable is not uniform across different levels of a third variable.

In the proposed study, the PROCESS macro model 92 (see Figure 3.1) will be employed to estimate the conditional indirect effects of perceived stress on academic achievement through the sequential mediators of rumination and mobile phone addiction, while also considering mental health literacy as a moderator. This advanced statistical technique enables the examination of whether the effect of perceived stress on academic outcomes, via the mediational path, is differentially influenced by students' mental health literacy. Bootstrapping, a nonparametric resampling procedure, with 5,000 samples, will be utilized to assess the bias-corrected confidence intervals for indirect effects, providing a robust test of mediation that does not assume

normality of the sampling distribution.

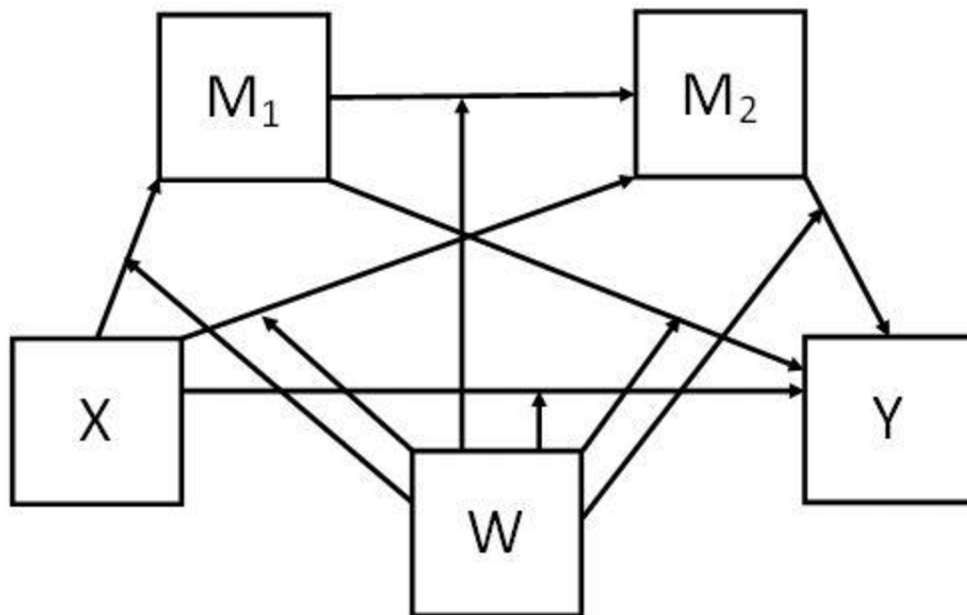


Figure 3.1 the PROCESS macro model 92

The inclusion of demographic control variables, such as age, gender, and academic major, serves to isolate the unique contribution of perceived stress, rumination, and mobile phone addiction to academic achievement. By accounting for this potential confounds, the analysis can more accurately attribute any observed effects to the variables of interest, rather than to extraneous demographic factors.

The methodological rigor of testing for moderated mediation through the PROCESS macro adds significant value to the field of educational psychology. It elucidates not only whether and how stress-related processes affect academic achievement but also identifies for whom these effects are most potent. Such insights have practical implications for educational interventions, as they highlight the importance of mental health literacy in buffering the negative impact of stress on students' academic success. The findings from this analysis will potentially inform tailored strategies to foster resilience and academic flourishing among undergraduate populations.

### 3.4 Ethical considerations

As with any research study involving human participants, it is important to consider and address ethical considerations to ensure that the study is conducted in a manner that is respectful, responsible, and fair to all participants. When conducting research, particularly involving human subjects, ethical considerations are paramount. The Helsinki Declaration, adopted by the World Medical Association in 1964 and subsequently revised multiple times, is an international document that provides guidance on the ethical principles for conducting medical research involving human participants. Although it focuses primarily on medical research, its principles can be applied more broadly, and researchers in various disciplines uphold its guidelines (Association, 2013).

**Informed Consent:** Every potential participant should be adequately informed about the aims, methods, anticipated benefits, and potential hazards of the study. They must be given ample time to consider participation and should not be coerced in any manner. Participation should always be voluntary.

**Confidentiality:** Researchers are obligated to protect the privacy and confidentiality of their participants. Any data that could potentially identify a participant should be kept secure and only accessible to those directly involved in the research.

**Non-maleficence:** This refers to the commitment of the researcher to do no harm. Participants should not be subjected to unnecessary risks, and any potential risks should be clearly outlined during the informed consent process.

**Beneficence:** The research should aim to bring about positive outcomes, not only for the scientific community but also for society at large.

**Right to Withdraw:** Every participant has the right to withdraw from the study at any point without facing any penalties or repercussions.

**Transparent Reporting:** All findings, whether they align with the hypothesis or not, should be reported transparently.

**Special Consideration for Vulnerable Groups:** Research involving children, elderly, and mentally incapacitated individuals or any group that can be deemed as vulnerable requires special attention to ensure their rights are protected.

**Post-Study Obligations:** Participants should be informed about the results of the study, and they should be provided with any necessary follow-ups, especially if any unforeseen risks manifest.

**Independent Review:** Before initiating the study, the research protocol should be reviewed by an independent ethics committee to ensure all ethical considerations are addressed.

## 4 Study 1: Comparison between the two countries

### 4.1 Research Objective

Research 1 follows a cross-sectional quantitative research design, employing structured psychological questionnaires to gather data from college students in China and the Czech Republic. The research instrument's format and dissemination medium have been tailored according to the preferred digital platforms of each region.

In an increasingly interconnected and rapidly changing world, the shared experiences and unique challenges faced by different populations merit academic exploration, particularly when understanding prevalent socio-psychological phenomena. This study pivots around such an exploration, delving deep into the realms of perceived stress, mobile phone addiction, and rumination. Below we outline



the research objectives pursued:

(1) Cross-cultural Comparison:

Primary Objective: To empirically compare and understand the patterns and levels of Perceived stress, Mobile phone addiction, Rumination, among college students in two culturally distinct regions: China and the Czech Republic.

(2) Understanding Perceived Stress:

Examine the prevalence, intensity, and sources of stress among college students in both countries. Understand the socio-cultural factors that might influence perceived stress in each context.

(3) Mobile Phone Addiction Exploration:

Quantify and analyze the extent of mobile phone addiction among college students in China and the Czech Republic. Investigate the underlying reasons, patterns of usage, and specific features or applications that may be contributing to such addiction.

(4) Rumination Assessment:

Assess the frequency and intensity of rumination among students from both countries. Examine if ruminative patterns vary based on cultural, academic, or socio-economic factors within each country.

(5) Inter-relationships and Overlaps:

Understand the possible interplay and correlations between perceived stress, mobile phone addiction, and rumination. For instance, does higher perceived stress lead to increased rumination or mobile phone addiction? Delve into whether the patterns of these inter-relationships differ between the Chinese and Czech student populations.

#### (6) Contextual Insights:

Extract socio-cultural insights that might elucidate the differences or similarities in the observed patterns. This would involve exploring cultural attitudes towards stress, coping mechanisms prevalent in each culture, societal views on mobile phone usage, and the intrinsic or extrinsic factors fostering rumination.

In essence, this study aims to offer a holistic, comparative lens, shedding light on the psychological intricacies of college students across China and the Czech Republic concerning perceived stress, mobile phone addiction, and rumination.

## 4.2 Research Method

### 4.2.1 Sampling

The study employed a cross-sectional design utilizing questionnaires. Participants were sourced from the Faculty of Education, Palacký University in Olomouc, Czech Republic, and the Faculty of Educational Sciences, Chongqing Normal University, Sichuan, China. The study received ethical clearance from Palacký University Olomouc.

#### **Inclusion Criteria:**

- Enrollment in full-time study programs at the respective Faculty of Education.
- Aged 18 or older.
- Nationality being either Czech or Chinese.
- Enrollment in teaching study programs having cleared the subject of educational competence.
- No restrictions were placed based on gender, socioeconomic status, language, or academic performance.

**Exclusion Criteria:**

- Non-Czech or non-Chinese nationals.
- Enrollment in part-time study programs.
- Students enrolled in study programs that didn't meet the required qualifications.

Consent was an essential criterion for participation. Respondents voluntarily consented to the study and agreed to anonymous data publication in the resulting publication.

**Study Demographics:**

Palacký University in Olomouc had a potential pool of over 2,000 students meeting the inclusion criteria, while Chongqing Normal University in Sichuan had an approximate target demographic of 1,800 students. Participants were reached via official university emails in the Czech Republic and the Wechat social app in China. Data was collected between February and April 2022 for the Czech cohort and from February to May 2023 for the Chinese group, using online questionnaires. Google Forms were utilized in the Czech Republic and Wenjuanxing in China, with both sets of questionnaires presented in their respective native languages. All received questionnaires were deemed valid for the study.

The study's final participant pool included 1,075 Czech students with a mean age of  $24.07 \pm 6.7$  years (84.9% females) and 710 Chinese students with a mean age of  $21.0 \pm 2.3$  years (54.6% females). The response rates were estimated at 50% for Czech students and around 40% for the Chinese participants. Most of the Czech students were in their second (48.7%) and first (30.3%) years, whereas Chinese students were primarily from the second (57.3%) and third (26.9%) years of study.

Table 4.1 provides a detailed breakdown of the sample characteristics, highlighting key demographics such as gender distribution and parents' educational background.

Table 4.1 Sample characteristics

	China	Czech
N	710	1075
Age, mean [SD]	21.0 [2.3]	24.07 [6.7]
Sex, N [%]		
Female	388 [54.6%]	913 [84.9%]
Male	322 [45.4%]	162 [15.1%]
Father's education, N [%]		
Primary school	324 [18.1%]	28 [1.6%]
Secondary school	96 [5.4%]	403 [22.6%]
Vocational college	33[1.8%]	327 [18.3%]
University	257 [14.4%]	318 [17.8%]
Mother's education, N [%]		
Primary school	407 [22.8%]	27 [1.5%]
Secondary school	87 [4.9%]	484 [27.1%]
Vocational college	28[1.6%]	220 [12.3%]
University	188 [10.5%]	345 [19.3%]
Parents' education, N [%]		
both primary	292[41.10%]	9[0.80%]
at least 1x high school	72[10.10%]	18[1.70%]
both high school	38[5.40%]	211[19.60%]
at least 1x vocational	28[3.90%]	255[23.70%]
both vocational	11[1.50%]	114[10.60%]
at least 1x university	93[13.10%]	275[25.60%]
both university	176[24.80%]	194[18.00%]

#### 4.2.2 Instrument

(1) The Perceived Stress Scale (PSS), developed by Sheldon Cohen, Kamarck, & Mermelstein (1994), was employed to gauge participants' perceived stress. This 10-item scale utilizes a 5-point scoring system, where 1 denotes "never" and 5 indicates "always." Scores can range from 10 to 50, with a higher score signifying greater perceived stress (Cohen et al., 1994). Previous research underscores the instrument's reliability for Chinese student populations (Deng et al., 2020; Lu et al., 2017), yielding an internal consistency coefficient of 0.84 in this study. For our Czech sample, we utilized the revised version of the PSS by N Figalová (2021). This version has demonstrated robust internal consistency with a Cronbach's  $\alpha$  of 0.825 and a McDonald's  $\omega$  of 0.90. Furthermore, its structural validity is validated by multiple metrics:  $\chi^2(35) = 1880.828$ , SRMR = 0.070, RMSEA = 0.175, NFI = 0.915, TLI = 0.893, CFI = 0.916, and IFI = 0.914 (Figalová & Charvát, 2021).

(2) The Ruminative Responses Scale: Developed by Susan Nolen-Hoeksema in 1991, this scale delves into three key dimensions of rumination: symptom rumination, brooding, and reflective pondering. Comprising 22 items, respondents indicate their agreement using a four-point scale, ranging from 1 (never) to 4 (always). A higher score denotes a more pronounced inclination towards a ruminative thought process (Susan Nolen-Hoeksema, 1991). Studies, such as that by Y. Li et al. (2019), validate its applicability to Chinese student populations. The scale exhibits commendable reliability, with subscale  $\alpha$ -values equating to 0.943.

(3) The Short Version of the Smartphone Addiction Scale (SAS-SV) was used (Kwon, 2013). The scale consists of 10 items rated on a six-point scale (1 = totally disagree, 6 = totally agree), with higher scores indicating a higher level of mobile phone addiction. The cronbach's  $\alpha$  was 0.885.

(4) Mental Health Literacy Scale modified by Han et al.(2019) from Mental Health Literacy Scale(MHLS) developed by O'Connor et al. (Z. Han, Wang, Ouyang, Niu, & Yun, 2019; O'Connor & Casey, 2015), it's a total of 35 items, divided as follows: Knowledge (15 items), understanding of where to find information (4 items), and attitudes conducive to recognizing and seeking appropriate assistance (16 items), using a 5-point assessment (with a range of 35-155 points, with higher scores reflecting better mental health literacy). Since item 34 of the original questionnaire "How willing would you be to vote for a politician if you knew they had suffered a mental illness?" is not consistent with China's social conditions, it was deleted. This is consistent with the study of Han et al. (2019) The same approach was adopted. Among them, item 10, 12, 15, 20-28 are reverse scored items. To make both subjects test the same content, this item was also deleted among the Czech subjects. The internal consistency reliability of knowledge was 0.718, and the internal consistency reliability of ability to acquire information was 0.70, and  $\alpha(\text{attitude}) = 0.852$ .

#### 4.2.3 Ethical Considerations

The authors unequivocally affirm adherence to the highest ethical standards throughout the research process. All procedures undertaken in this study align scrupulously with the ethical guidelines set by pertinent national and institutional bodies overseeing human experimentation. Additionally, the study upholds the principles enshrined in the Helsinki Declaration of 1975, with its subsequent revisions, most recently in 2008.

Prior to their participation, all respondents were apprised of the stringent measures in place to maintain the confidentiality and anonymity of their responses. An online informed consent form, detailing the scope and purpose of the study, as well as participants' rights, was presented to each participant. This form had to be

acknowledged and signed digitally before they could proceed with completing the questionnaire.

To further bolster our commitment to privacy, no granular data, including but not limited to IP addresses, student names, ID numbers, or specific academic disciplines, were captured during the online data collection phase. This was a deliberate decision to eliminate any potential traces that could lead back to an individual participant.

Furthermore, before the onset of data collection, the research protocol underwent rigorous scrutiny and received formal approval from the Ethics Committee of the Faculty of Education. This added layer of vetting underscores the meticulous attention to ethical considerations throughout the study's progression.

#### 4.3 Data Analysis

In the analytical process, a combination of robust statistical methods was employed to decipher the intricate relationships between variables and contrast the differences among student groups from the two countries. Firstly, to ensure the internal consistency of the measurement instruments, Cronbach's alpha was computed using SPSS 22.0, providing a gauge of the reliability of the scales employed in this study. To compare the differences between the student cohorts from China and the Czech Republic, an independent sample t-test was used for normally distributed data. For data not adhering to the normality assumption, the non-parametric Wilcoxon rank sum test was employed, offering an alternative to test for significant differences between groups without the strict assumptions of the t-test.

Moving on to the structural validity of the questionnaire, a structural equation model (SEM) was deployed. Leveraging the capabilities of AMOS 22.0, the SEM technique provided insights into the latent constructs and the relationships between

them. This allowed for a rigorous test of the proposed relationships and paths in the hypothesized model, ensuring that the data fit the theoretical assumptions. The model's goodness-of-fit indices, path coefficients, and other essential statistics were derived from AMOS, furnishing a comprehensive picture of the relationships within the model.

The fusion of these statistical methods provided a rigorous and holistic examination of the study's objectives, enabling robust inferences and conclusions drawn from the data. To assess the potential impact of common method bias in the study, Harman's single-factor test was employed (Aguirre-Urreta & Hu, 2019). Using dimensionality reduction in SPSS 22.0, the analysis revealed that the variance explained by the first factor was less than the critical threshold of 40%. This indicates that the study is not significantly affected by common method bias, suggesting that the findings and interpretations derived from the data are robust and less likely to be influenced by any singular underlying factor.

#### 4.4 Research Result

##### 4.4.1 Country Difference

##### 4.4.1.1 Perceived stress

To understand the difference in perceived stress levels between college students from China and the Czech Republic, we employed an independent sample t-test. Table 4.1 presents the comparative results, elucidated below:

Table 4.1 The comparison of Perceived stress between two countries

Country	M	SD	t	p	Cohens'd
China	29.33	4.87	-6.039	<0.001	-0.29
Czech	31.15	6.99			

Chinese students reported an average perceived stress score of 29.33, The



variability of stress scores among Chinese students, as represented by the standard deviation, was 4.87. In contrast, Czech students demonstrated a slightly higher average stress score of 31.15, Czech students showed a slightly larger variability with a standard deviation of 6.99. The t-value, which indicates the difference in perceived stress scores between the two groups in terms of standard error units, was -6.039. This negative value suggests that Czech students, on average, had higher perceived stress scores compared to their Chinese counterparts. The observed p-value was < 0.001. This is statistically significant and indicates that the difference in perceived stress scores between Chinese and Czech students is not likely due to random chance. Cohen's d value was -0.29. This negative value aligns with the direction of the t-value, confirming that Czech students had higher stress scores. The magnitude of 0.29 represents a medium effect size, suggesting a moderate difference in perceived stress levels between the two student groups. In conclusion, the result reveals a statistically significant difference in perceived stress levels between Chinese and Czech college students, with Czech students displaying higher average stress levels.

#### 4.4.1.2 Rumination

To discern the potential distinctions in rumination levels of college students from China and the Czech Republic, we employed the independent sample t-test. The findings from this comparison are encapsulated in Table 4.2 and detailed below:

**Table 4.2 The comparison of Rumination between two countries**

	M	SD	t	p	Cohens'd
China	45.03	13.60	-	<0.001	-0.36
Czech	50.22	14.28	7.659		

Chinese students registered an average rumination score of 45.03, The variation in rumination scores among Chinese students, denoted by the standard deviation, was 13.60. Czech students, on the other hand, exhibited a higher average rumination score

of 50.22, Czech students revealed a slightly greater variability with a standard deviation of 14.28. The t-value came out to be -7.659. This negative value indicates that Czech students have higher rumination scores on average in comparison to their Chinese counterparts. The deduced p-value was < 0.001. Such a low p-value denotes statistical significance, indicating that the observed differences in rumination scores between Chinese and Czech students are very unlikely to have occurred due to mere chance. Cohen's d value was found to be -0.36. This negative value aligns with the negative t-value, emphasizing that Chinese students have a lower mean score. Moreover, a Cohen's d value of -0.36 is indicative of a small to medium effect size, suggesting that while the difference is significant, it's not extremely large. To conclude, the analysis sheds light on a statistically significant difference in rumination levels between college students from China and the Czech Republic. Specifically, Czech students tend to ruminate more than their Chinese peers.

#### 4.4.1.3 Mobile Phone Addiction

The potential variation in mobile phone addiction levels among college students from China and the Czech Republic was investigated through an independent sample t-test. The detailed findings derived from this analysis are encapsulated in Table 4.3:

**Table 4.3 The comparison of Mobile phone addiction between two countries**

	M	SD	t	p	Cohens'd
China	35.27	8.19	25.410	<0.001	1.203
Czech	24.59	9.01			

Chinese college students exhibited an average mobile phone addiction score of 35.27, the dispersion of mobile phone addiction scores among the Chinese student cohort was noted to have a standard deviation of 8.19. On the other hand, Czech college students reported a considerably lower average score of 24.59, the Czech

students demonstrated a slightly higher variability in their scores with a standard deviation of 9.01. The t-value was determined to be 25.410. This positive t-statistic signifies that the mean mobile phone addiction score for Chinese students is significantly higher than that of the Czech students. A p-value of  $< 0.001$  was recorded. This exceedingly low p-value accentuates the statistical significance of the differences observed. It affirms that the variation in mobile phone addiction scores between the two populations is genuine and not merely due to random chance. The Cohen's d value was ascertained to be 1.203. This value indicates a large effect size, which suggests a substantial difference in mobile phone addiction levels between the two groups. In conclusion, the study unveiled a pronounced and statistically significant disparity in mobile phone addiction levels between college students from China and the Czech Republic. Chinese students exhibited higher tendencies towards mobile phone addiction than their Czech counterparts.

#### 4.4.1.4 Mental Health Literacy

In our investigation of mental health literacy across two distinct student populations, our analyses draw clear contrasts between Czech and Chinese university students. This section elaborates on the results derived from the provided tables and statistical graphs.

The mean mental health literacy score for Czech university students was 124.18 with a standard deviation of 11.41. In contrast, Chinese university students scored a mean of 107.31 with a standard deviation of 11.20. The t-value for country difference was -30.78, which was statistically significant with a p-value of less than 0.001. The effect size, as calculated using Cohen's d, was 1.45, indicating a large effect size (see table 4.4 and figure 4.1).

(1) Knowledge: Czech students had a mean score of 48.91 with a standard

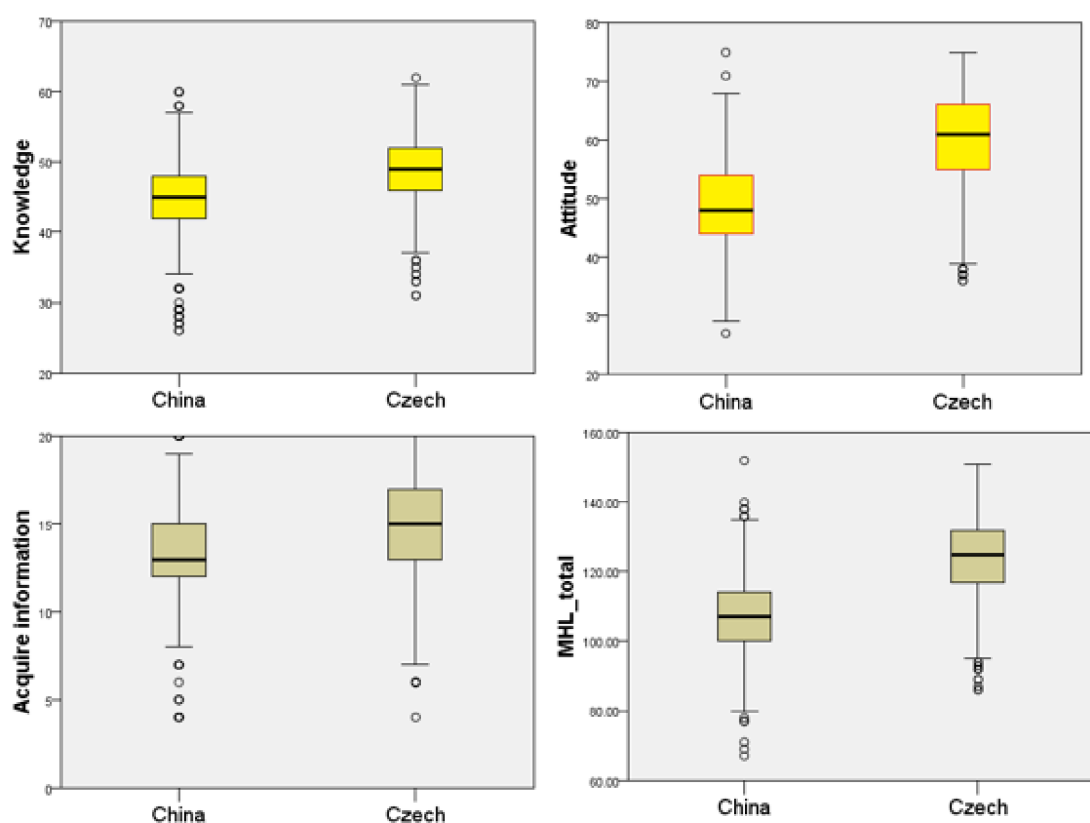
deviation of 4.74. Chinese students, on the other hand, had a mean score of 45.02 with a standard deviation of 5.69. The t-value for this dimension was -15.706, and the difference was statistically significant with a p-value of less than 0.001. The effect size was medium to large, with a Cohen's d of 0.74.

(2) Information: For the information dimension, Czech students had a mean score of 15.12 with a standard deviation of 2.71, while Chinese students had a mean score of 13.39 with a standard deviation of 2.84. The t-value for this dimension was -12.986, again indicating a statistically significant difference with a p-value of less than 0.001. The effect size was medium with a Cohen's d of 0.61.

(3) Attitude: Czech students recorded a mean score of 60.14 with a standard deviation of 7.78. This was contrasted by the Chinese students' mean score of 48.91 with a standard deviation of 7.28. The t-value for the attitude dimension was -30.878, and the difference was statistically significant with a p-value of less than 0.001. The effect size was large, with a Cohen's d of 1.46.

**Table 4.4. Differences in mental health literacy scores between countries**

	Mean [SD]		Country difference		
	China	Czech	t	adj.P	Cohen's d
Total score	107.31 [11.20]	124.18 [11.41]	-30.787	<0.001	1.45
Dimension					
Knowledge	45.02 [5.66]	48.91 [4.74]	-15.706	<0.001	0.74
Information	13.39 [2.84]	15.12 [2.71]	-12.986	<0.001	0.61
Attitude	48.91 [7.28]	60.14 [7.68]	-30.878	<0.001	1.46



**Figure 4.1. Boxplots of mental health literacy scales in individual countries..**

Figure 4.1 provides boxplot visualizations of the mental health literacy scores for each dimension across the two countries. The plots further illustrate the consistent higher scores achieved by Czech students across all dimensions in comparison to their Chinese counterparts.

Overall, the statistical analysis reveals that Czech university students consistently

outperformed their Chinese peers in terms of mental health literacy across all measured dimensions. The observed differences were not only statistically significant but also of substantive magnitude, especially in the attitude dimension.

#### 4.4.2 Differences between countries in respect to gender

##### 4.4.2.1 Perceived stress

The current study in this section aimed to compare the perceived stress scores between Chinese and Czech college students, while also assessing gender differences using the independent sample t-test (see table 4.5).

The mean perceived stress score for male Czech students was 31.8 (SD = 3.8), while for female Czech students, it was slightly lower at 31.5 (SD = 1.7). This gender difference was statistically significant with an adjusted p-value of 0.0465\* and a small effect size (Cohen's  $d = 0.002$ ). For Chinese students, males had a mean score of 29.8 (SD = 4.3) and females had a mean score of 29.32 (SD = 5.2). The gender difference in perceived stress scores in Chinese students was not significant with an adjusted p-value of 0.919.

The difference in perceived stress scores between Czech and Chinese male students was significant with a mean difference of -3.734 ( $p < 0.001^*$ ). The effect size for this comparison was moderate with Cohen's  $d$  of 0.34. Similarly, there was a significant difference in perceived stress scores between Czech and Chinese female students with a mean difference of -4.571 ( $p < 0.001^*$ ). The effect size for this difference was also moderate with Cohen's  $d$  of 0.25.

Table 4.5 Differences in perceived stress scores between countries in respect to gender

Variable	Comparison	Mean [SD]		Country difference		
		Male	Female	t	P	Cohen's d
Perceived stress	Male vs. female (Czech)	31.18 [6.3]	31.15 [7.1]	0.043	0.965	0.002
	Male vs. female (China)	29.36 [4.3]	29.32 [5.2]	0.102	0.919	0.007
	Czech vs. China (males)			-3.734	<0.001	0.34
	Czech vs. China (females)			-4.571	<0.001	0.25

The research results indicate that there is a significant difference in perceived stress scores between Czech and Chinese college students, with Czech students generally reporting higher stress levels. Gender differences were only significant within the Czech sample.

#### 4.4.2.2 Rumination

We compare the rumination scores between Chinese and Czech college students while delineating any potential gender differences. The comparisons were made using the independent sample t-test (see table 4.6).

The mean rumination score for male Czech students was 50.35 (SD = 11.4), whereas for female Czech students, the score was slightly lower at 50.20 (SD = 13.4). The difference in rumination scores between genders within the Czech cohort was not statistically significant, with an adjusted p-value of 0.9065. Among Chinese students, males reported a mean score of 45.5 (SD = 14.6), and females reported a slightly higher mean score of 48.64 (SD = 12.7). The gender difference within the Chinese cohort was also not statistically significant, with an adjusted p-value of 0.400.

When comparing the rumination scores of male students from Czech Republic

and China, there was a significant difference with a mean difference of -3.471 ( $p < 0.001^*$ ). This difference had a moderate effect size, as indicated by Cohen's  $d$  value of 0.32. There was also a significant difference in the rumination scores between Czech and Chinese female students, with a mean difference of -6.871 ( $p < 0.001^*$ ). This difference had a more substantial effect size, with Cohen's  $d$  equal to 0.37.

Table 4.6 Differences in rumination scores between countries in respect to gender

Variable	Comparison	Mean [SD]		Country difference		
		Male	Female	t	P	Cohen's d
Rumination	Male vs. female (Czech)	50.35 [14.1]	50.20 [14.3]	0.119	0.905	0.007
	Male vs. female (China)	45.5 [14.6]	46.64 [12.7]	0.842	0.400	0.06
	Czech vs. China (males)			-3.471	<0.001	0.32
	Czech vs. China (females)			-6.671	<0.001	0.37

The findings suggest significant cross-country differences in rumination scores between Chinese and Czech college students. While Czech students, both male and female, exhibited higher levels of rumination than their Chinese counterparts, gender differences within each country were not pronounced.

#### 4.4.2.3 Mobile Phone Addiction

This section aimed to compare the mobile phone addiction scores between Chinese and Czech college students and investigate any gender-specific differences. The data was analyzed using the independent sample t-test (see table 4.7).

Among Czech college students, males exhibited a mean mobile phone addiction score of 25.18 (SD = 12.9), while females reported a slightly lower score of 24.49 (SD = 9.0). However, this gender difference was not statistically significant, as



reflected by an adjusted p-value of 0.3698. In the cohort of Chinese students, males had a mean addiction score of 35.28 (SD = 8.9), and females showed a closely aligned score of 35.27 (SD = 7.5). Interestingly, the gender difference within the Chinese cohort was also statistically insignificant, with an adjusted p-value of 0.9822.

A comparison of male students from the Czech Republic and China revealed a substantial difference in mobile phone addiction scores, with a mean difference of 11.604. This difference was statistically significant ( $p < 0.001^*$ ) and showcased a large effect size, as denoted by a Cohen's d value of 1.06. Female students from the Czech Republic and China also exhibited a marked difference in their mobile phone addiction scores, with a mean difference of 20.786. This difference was statistically significant ( $p < 0.001^*$ ) and demonstrated a very large effect size, with Cohen's d equal to 1.15.

Table 4.7 Differences in mobile phone addiction scores between countries in respect to gender

Variable	Comparison	Mean [SD]		Country difference		
		Male	Female	t	adj.P	Cohen's d
Mobile addiction	Male vs. female (Czech)	25.18 [9.2]	24.49 [9.0]	0.898	0.369	0.05
	Male vs. female (China)	35.28 [8.9]	35.27 [7.5]	0.023	0.982	0.001
	Czech vs. China (males)			11.604	<0.001	1.06
	Czech vs. China (females)			20.766	<0.001	1.15

In summary, while gender differences within each country regarding mobile phone addiction scores were not evident, there were significant cross-country differences. Specifically, both male and female Chinese students demonstrated higher

mobile phone addiction scores than their Czech counterparts. The considerable effect size suggests a meaningful distinction between the two cohorts.

#### 4.4.2.4 Mental Health Literacy

Utilizing the independent sample t-test, this research embarked on examining the variances in mental health literacy between Chinese and Czech college students while highlighting the disparities across genders. (see table 4.8 and figure 4.2):

##### (1) Total scores in Mental Health Literacy:

For Czech males, the mean score was 125.4 (SD = 12.2) compared to females who scored 123.98 (SD = 11.2). The gender difference, indicated by a p-value of 0.139, was not statistically significant. Chinese male students recorded a mean score of 105.07 (SD = 11.0) while female students scored 109.77 (SD = 11.0). With a p-value of 0.001, this difference is statistically significant, indicating a higher literacy rate in females.

##### (2) Knowledge of Mental Health Issues:

Males reported a mean score of 49.53 (SD = 4.9), slightly higher than the females' score of 48.9 (SD = 4.7). With a p-value of 0.072, the gender difference was not statistically significant. Chinese male students scored an average of 44.39 (SD = 6.2), whereas females registered 45.64 (SD = 5.0). This difference was significant with a p-value of 0.007.

##### (3) Acquire Information in Mental Health Literacy:

Czech male students obtained a mean score of 15.04 (SD = 2.8) versus 15.13 (SD = 2.7) for female students. The p-value of 0.693 suggests an insignificant gender difference. For Chinese students, males scored 13.41 (SD = 2.2) on average, slightly lower than females who scored 13.37 (SD = 2.4). The gender difference was

insignificant, with a p-value of 0.838.

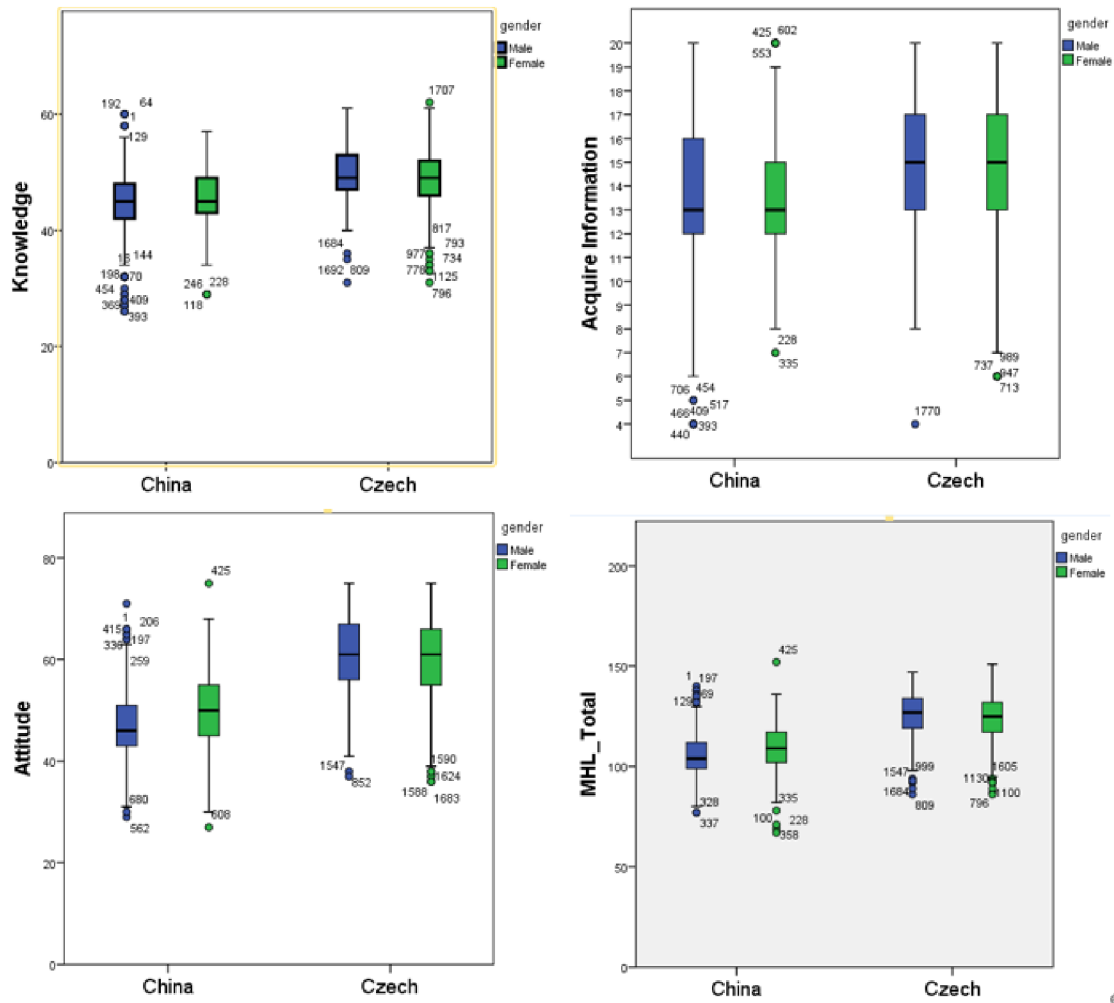
#### (4) Attitude

Czech males had an average score of 60.83 (SD = 8.2), while females scored slightly lower at 60.02 (SD = 7.8). This difference, however, was not statistically significant, as reflected by the p-value of 0.220. Chinese male students reported an average score of 47.27 (SD = 6.9) compared to 50.07 (SD = 7.2) for females. This difference was statistically significant with a p-value of <0.001.

Table 4.8 Differences in mental health literacy scores between countries in respect to gender

Variable	Comparison	Mean [SD]		Country difference		
		Male	Female	t	P	Cohen's d
Total score	Male vs. female (Czech)	125.4 [12.2]	123.96 [11.2]	1.480	0.139	0.09
	Male vs. female (China)	105.07 [11.0]	109.17 [11.0]	-4.936	0.001	0.37
	Czech vs. China (males)			-18.452	<0.001	1.68
	Czech vs. China (females)			-21.816	<0.001	1.21
Knowledge	Male vs. female (Czech)	49.53 [4.9]	48.9 [4.7]	1.802	0.072	0.10
	Male vs. female (China)	44.39 [6.2]	45.54 [5.0]	-2.699	0.007	0.20
	Czech vs. China (males)			-9.117	<0.001	0.83
	Czech vs. China (females)			-11.196	<0.001	0.62
Information	Male vs. female (Czech)	15.04 [2.8]	15.13 [2.7]	-0.395	0.693	0.02
	Male vs. female (China)	13.41 [3.2]	13.37 [2.4]	0.205	0.838	0.01
	Czech vs. China (males)			-5.498	<0.001	0.50
	Czech vs. China (females)			-11.072	<0.001	0.61
Attitude	Male vs. female (Czech)	60.83 [8.2]	60.02 [7.6]	1.226	0.220	0.07
	Male vs. female (China)	47.27 [6.9]	50.27 [7.2]	-5.576	<0.001	0.42

Czech vs. China (males)			<0.00
	-19.064	1	1.74
Czech vs. China (females)			<0.00
	-21.470	1	1.19



**Figure 4.2. Boxplots of mental health literacy scales across countries by gender.**

The box plot visualization amplifies the observed gender-based variations in mental health literacy scores within each nation. Furthermore, when juxtaposed, Czech college students consistently displayed superior scores in mental health literacy compared to their Chinese peers across all metrics. In summary, the research unveiled

certain gender-based differences in mental health literacy scores within each country, especially among Chinese students were females generally outperformed males.

When assessing the results across countries, Czech college students exhibited superior mental health literacy relative to their Chinese counterparts.

#### 4.4.3 Inter-countries differences in respect to combined education of parents

##### 4.4.3.1 Perceived stress

Table 4.9 presents the inter-country differences in perceived stress scores, segmented by the combined education levels of the parents. The following metrics are observed:

For all educational categories, the perceived stress levels for Chinese students tend to have a higher median than Czech students, with the exception of the 'Both university' category.

The distribution spread (interquartile range) for perceived stress among Chinese students, particularly in the 'Both primary' and 'Both vocational' categories, is narrower than that of Czech students. This suggests that the stress perceptions among Chinese students in these categories are more consistent compared to their Czech counterparts.

Outliers are visible in both countries across different educational categories, indicating that there are individual cases where students experience stress levels significantly different from their peers.

Table 4.9 Inter-countries differences in perceived stress scores in respect to combined education of parents

Variable	Education	Mean [SD]		Country difference		
		Czech	China	W	P	r
Perceived stress	Both primary	25.2 [7.0]	29.6 [4.2]	721	0.013	0.486
	At least 1x high school	33.3 [8.0]	29.2 [5.2]	3079	0.046	0.304
	Both high school	30.2 [6.5]	29.7 [5.9]	4666.5	0.838	0.021
	At least 1x vocational	31.6 [7.2]	29.2 [4.5]	3230	0.069	0.208
	Both vocational	30.9 [7.0]	31.4 [5.9]	7145.5	0.750	0.06
	At least 1x university	31.3[7.0]	31.2[4.6]	17088	0.937	0.006
	Both university	31.6[6.8]	27.8[5.3]	26567	<0.001	0.356

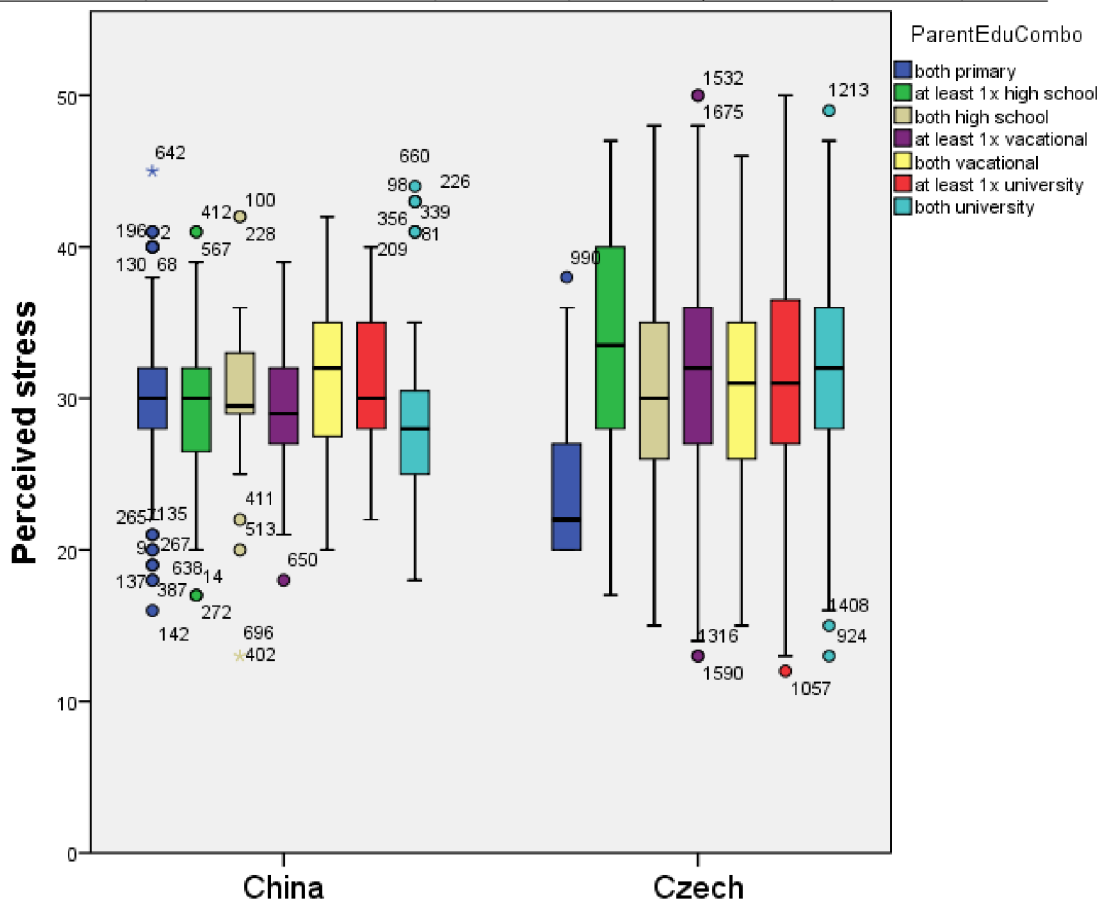


Figure 4.3 Boxplots of perceived stress across countries based on combined education of parents.

Figure 4.3 visually demonstrates the distribution of perceived stress levels among college students in the Czech Republic and China, based on the education

level of their parents.

For all educational categories, the perceived stress levels for Chinese students tend to have a higher median than Czech students, with the exception of the 'Both university' category.

The distribution spread (interquartile range) for perceived stress among Chinese students, particularly in the 'Both primary' and 'Both vocational' categories, is narrower than that of Czech students. This suggests that the stress perceptions among Chinese students in these categories are more consistent compared to their Czech counterparts.

Outliers are visible in both countries across different educational categories, indicating that there are individual cases where students experience stress levels significantly different from their peers.

The comparative analysis suggests that the educational attainment of parents does influence the perceived stress levels of college students, albeit differently, in the Czech Republic and China. While there are certain categories where the stress perception is more pronounced and statistically significant, in others, the differences are negligible.

#### 4.4.3.2 Rumination

Table 4.10 illustrates inter-country variations in rumination scores concerning the combined education of parents for college students in the Czech Republic and China.

For college students whose parents both attained only primary education, Czech students reported a mean rumination score of 46.1 with a standard deviation (SD) of 13.8, while Chinese students reported a slightly higher mean of 47.1 with an SD of 11.1. The statistical effect size ( $r$ ) for this category is 0.096, indicating a small effect



size.

In the category where at least one parent completed high school, Czech students reported a mean rumination score of 53.2 (SD = 12.3), while their Chinese counterparts had a mean score of 46.8 (SD = 12.2). The effect size for this group is medium at 0.32.

No significant differences in rumination scores were observed for students with both parents completing high school, at least one parent attending vocational training, both parents attending vocational training, or at least one parent having a university education. These groups all displayed small effect sizes ( $r < 0.2$ ).

However, for students with both parents having a university education, there was a pronounced difference. Czech students reported a mean score of 51.6 (SD = 14.4), whereas Chinese students had a lower mean score of 35.2 (SD = 13.8). The effect size for this group is large ( $r = 0.614$ ).

Table 4.10 Inter-countries differences in rumination scores in respect to combined education of parents

Variable	Education	Mean [SD]		Country difference		
		Czech	China	W	adj.P	r
Rumination	Both primary	46.1 [13.8]	47.1 [11.1]	1233	0.624	0.096
	At least 1x high school	53.2 [12.3]	46.8 [12.2]	3068.5	0.036	0.32
	Both high school	48.7 [14.5]	48.2 [10.4]	4716.5	0.935	0.008
	At least 1x vocational	50.6 [14.1]	54.6 [17.7]	35977.5	0.572	0.066
	Both vocational	49.9 [13.9]	50.6 [13.8]	7148	0.767	0.054
	At least 1x university	50.2[14.4]	50.9[11.5]	50668	0.938	0.006
	Both university	51.6[14.4]	35.2[13.8]	22163	<0.001	0.614

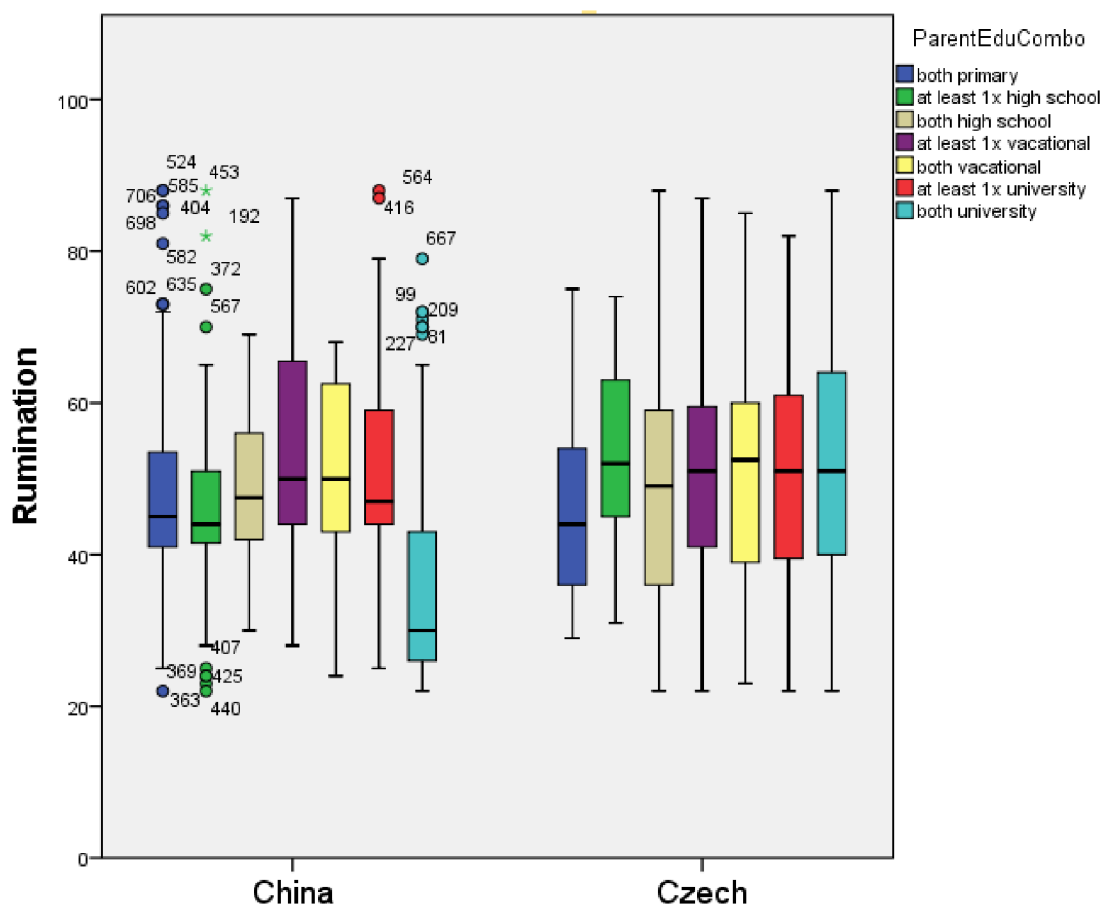


Figure 4.4 Boxplots of Rumination across countries based on combined education of parents.

Figure 4.4 offers a visual representation of the spread and central tendency of

rumination scores for each parental education category. The boxes represent the interquartile range (IQR) with the line inside the box indicating the median. The whiskers extend to the maximum and minimum values that are not outliers, and outliers are depicted as individual points.

Chinese students show more variation in their scores, particularly in the "both primary" and "both vocational" categories, as evidenced by the wider boxes and presence of outliers.

In contrast, Czech students displayed more consistent rumination scores across different parental education levels. However, the "both university" category for Czech students notably has a higher median compared to their Chinese counterparts.

The data suggests that there are clear variations in rumination levels between Czech and Chinese college students based on the combined educational attainment of their parents. The most significant difference was observed among students with both parents holding a university degree, where Czech students reported higher rumination scores than their Chinese peers. This discrepancy highlights the potential cultural or educational system differences impacting the psychological wellbeing of students in these two countries.

#### 4.4.3.3 Mobile Phone Addiction

The study aimed to investigate the differences in mobile phone addiction scores among college students in the Czech Republic and China. The scores were analyzed in relation to the combined educational level of the students' parents. The Wilcoxon rank sum test was utilized to determine the statistical significance, see table 4.11:

(1) Both primary school: In the Czech Republic, students whose parents both had primary education had an average mobile phone addiction score of 20.0 (SD=0.87).

Conversely, in China, the score was significantly higher at 35.8 (SD=7.4) with a large effect size ( $r=0.816$ ).

(2) At least 1x high school: Students in the Czech Republic exhibited a score of 22.1 (SD=1.8), while those in China showed a score of 34.9 (SD=10.5). The effect size for this category was medium ( $r=0.67$ ).

(3) Both high school: Czech students showcased a score of 24.3 (SD=8.5), slightly lower than the Chinese students at 36.6 (SD=8.4). The difference had a medium effect size ( $r=0.7$ ).

(4) At least 1x vocational: For this category, Czech students had a score of 23.8 (SD=8.5), whereas Chinese students scored 39.9 (SD=10.6) with a large effect size ( $r=0.788$ ).

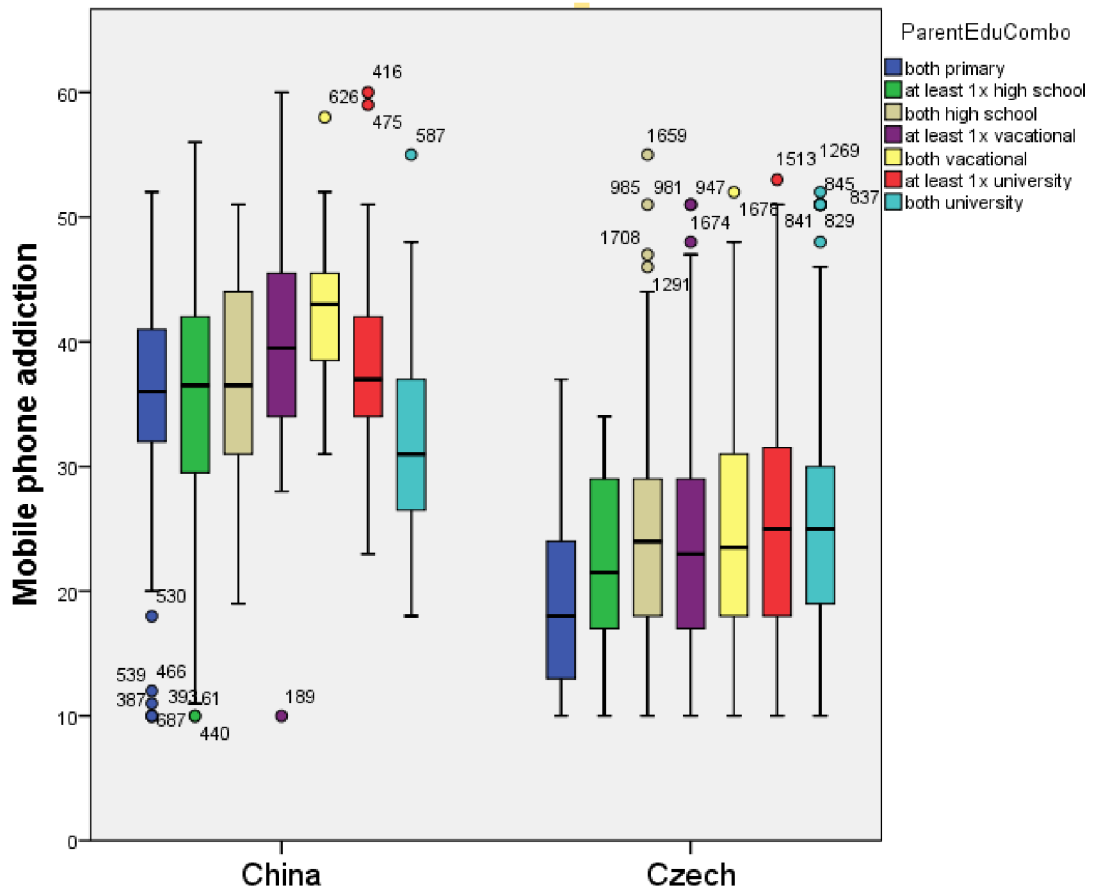
(5) Both vocational: Interestingly, both countries had close scores, with the Czech Republic at 24.8 (SD=9.1) and China at 42.5 (SD=8.0). However, the effect size was small ( $r=0.054$ ).

(6) At least 1x university: Students in the Czech Republic had a score of 25.9 (SD=2.1), while Chinese students had 38.6 (SD=7.1). The effect size was large ( $r=0.748$ ).

(7) Both university: The Czech students exhibited a score of 25.6 (SD=9.9), while their Chinese counterparts had a score of 31.6 (SD=7.1), with a medium effect size ( $r=0.42$ ).

Table 4.11 Inter-countries differences in mobile phone addiction scores in respect to combined education of parents

Variable	Education	Mean [SD]		Country difference		
		Czech	China	W	adj.P	r
Mobile phone addiction	Both primary	20.0 [8.7]	35.8 [7.4]	288	<0.001	0.816
	At least 1x high school	22.1 [8.1]	34.9 [10.5]	385	0.001	0.67
	Both high school	24.3 [8.5]	36.6 [8.4]	23572.5	<0.001	0.7
	At least 1x vocational	23.8 [8.5]	39.9 [10.6]	33398	<0.001	0.78
	Both vocational	24.8 [9.1]	42.5 [8.0]	7148	0.767	0.054
	At least 1x university	25.2[9.2]	38.2[6.7]	41176.5	<0.001	0.748
	Both university	25.6[9.9]	31.6[7.1]	28811	<0.001	0.420



**Figure 4.5 Boxplots of Mobile phone addiction across countries based on combined education of parents.**

Figure 4.5 visually represents the distribution of mobile phone addiction scores across different parental education levels for both countries.

For students with parents having both primary education, Chinese students showed a wider range of scores and a notably higher median score compared to Czech students. A similar pattern was observed for at least 1x high school and both high school categories, where Chinese students consistently had a higher median score than their Czech counterparts. For the at least 1x vocational category, the range of scores was broader for Chinese students, and their median score was higher as well. Both vocational had overlapping interquartile ranges for both countries, but the median score for Chinese students was slightly higher. At least 1x university showed Chinese students having a broader range and higher median score. Lastly, in the both

university category, although both countries had overlapping interquartile ranges, the median for the Chinese students was higher than the Czech students.

Across all parental education levels, Chinese college students consistently exhibited higher mobile phone addiction scores than their Czech counterparts. The effect size ranged from small to large, indicating varying degrees of practical significance for these observed differences.

#### 4.4.3.4 Mental Health Literacy

Table 4.12 presents an inter-country comparative analysis of the mental health literacy scores between college students from the Czech Republic and China. The scores are segmented based on the education levels of the students' parents. The Wilcoxon rank sum test is employed to identify statistically significant differences, and the effect size  $r$  helps quantify the magnitude of these differences.

First, on the total score, across all categories of parental education, students from the Czech Republic consistently showcased higher mental health literacy scores compared to those from China. The most marked difference is seen among students whose parents have both attained university education, with scores being 126.2 for the Czech Republic and 107.2 for China. All the differences across the parental education categories were statistically significant with  $p$ -values less than 0.001. The corresponding effect sizes for these categories were largely considered, ranging from medium to large.

Second, for the mental health knowledge component, students from the Czech Republic generally displayed higher scores than their Chinese peers across most parental education categories. The difference was most pronounced among students with parents having both a vocational education, with scores at 49.0 for the Czech

Republic and 44.2 for China. The effect sizes in this category primarily oscillated between small and medium, signifying variable levels of practical significance.

There was a mixed pattern observed in the scores related to the ability to acquire information. Czech students surpassed Chinese students when both sets of parents had either primary education, both had high school education, or both attended universities. Conversely, Chinese students outscored their Czech counterparts in situations where parents had at least one vocational education, both had vocational education, or at least one attended university. Statistically significant differences were predominantly observed, except for students with parents that had at least one high school or both high school education. The effect sizes in this domain remained largely in the medium range, suggesting moderate practical implications.

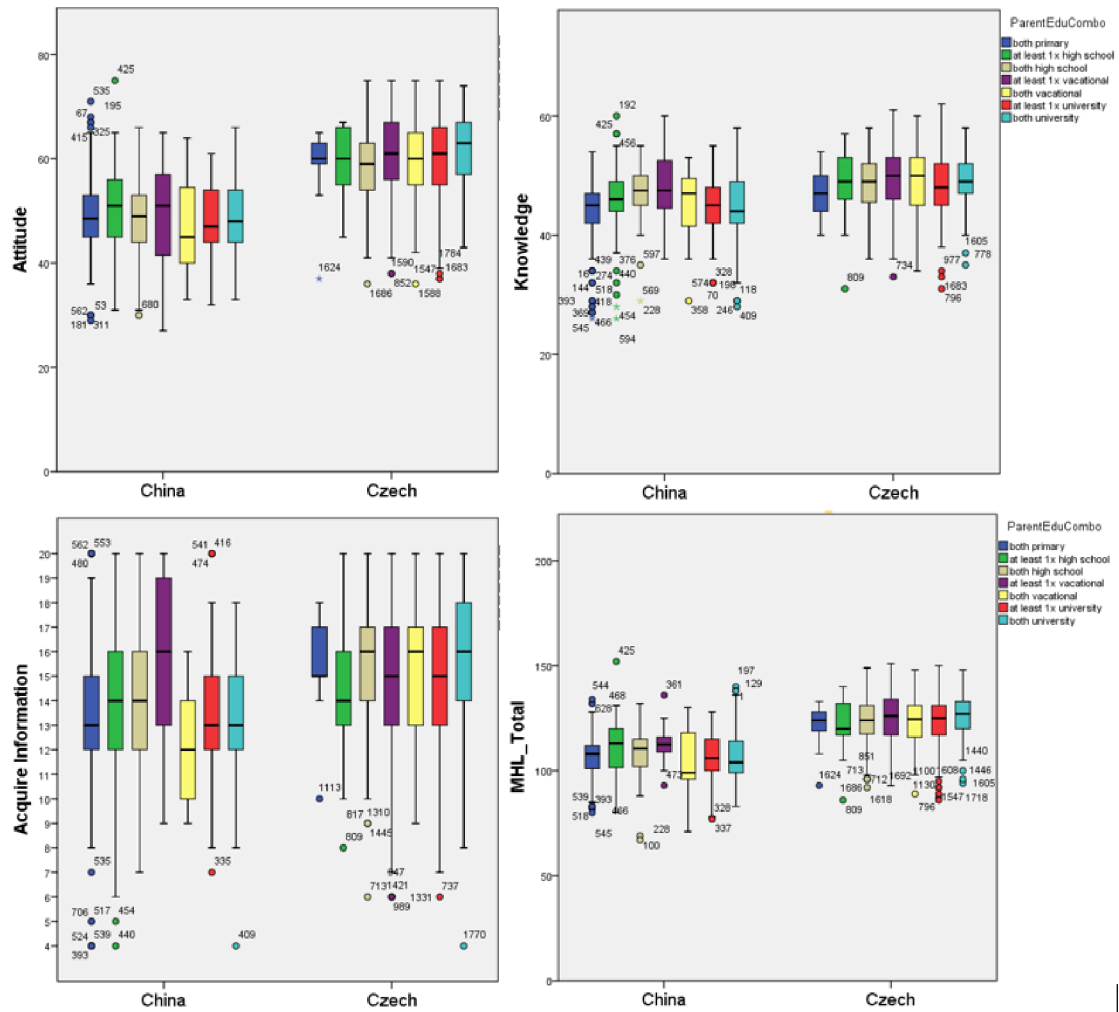
Finally, Czech students exhibited higher level of attitude score towards mental health across all parental education backgrounds compared to Chinese students. The widest gap in attitude scores was noted among students whose parents both had primary education, with the Czech Republic averaging 57.9 and China at 49.8. A notable difference is evident among students with parents who both pursued university education, registering scores of 60.3 for the Czech Republic and 49.2 for China. All differences in attitude scores between the two countries were found to be statistically significant ( $p$ -value  $<0.001$ ), most of the effect sizes in this section were medium to large, pointing to substantial practical differences in attitudes towards mental health based on the parental education backgrounds in these countries.



Table 4.12 Inter-countries differences in mental health literacy scores in respect to combined education of parents

Variable	Education	Mean [SD]		Country difference		
		Czech	China	W	P	r
Total score	Both primary	120.0 [12.3]	106.4 [9.1]	43249. 0	<0.00 1	0.64 2
	At least 1x high school	121.7 [13.0]	110.9 [12.9]	2953.5	0.001	0.49 8
	Both high school	123.0 [11.1]	108.1 [13.8]	2230.5	<0.00 1	0.62 8
	At least 1x vocational	125.0 [11.5]	112.5 [8.5]	1796	<0.00 1	0.61
	Both vocational	123.5 [12.1]	103.4 [16.5]	272.5	<0.00 1	0.67
	At least 1x university	123.5[11.8 ]	105.8[11.8 ]	7865.5	<0.00 1	0.72 6
	Both university	126.2[10.2 ]	107.2[12.1 ]	19974	<0.00 1	0.74 2
	Knowledge	Both primary	46.89 [4.6]	44.42 [5.0]	43738. 5	0.168
At least 1x high school		48.5 [6.3]	46.2 [6.3]	3113.5	0.1	0.25
Both high school		48.8 [4.4]	46.3 [6.6]	4009	<0.06 9	0.18 4
At least 1x vocational		49.3 [6.2]	47.7 [4.9]	3337	0.119	0.17 8
Both vocational		49.0[5.0]	44.2[7.1]	438	0.026	0.40 6
At least 1x university		48.4[5.0]	44.9[5.5]	12861	<0.00 1	0.33 6
Both university		49.4[4.0]	45.0[5.8]	24344. 5	<0.00 1	0.48 6
Acquire Information		Both primary	15.22 [2.3]	13.24 [2.8]	43469. 5	0.014
	At least 1x high school	14.4 [3.3]	13.8 [2.9]	3215.5	0.538	0.09 4

	Both high school	15.3 [2.5]	14.1 [3.3]	3753.5	0.014	8	0.24
	At least 1x vacational	14.9 [2.9]	15.8 [3.5]	35652. 5	0.173	6	0.15
	Both vocational	15.1 [2.7]	11.9 [2.3]	288	<0.00 1	6	0.64
	At least 1x university	14.9[2.8]	13.2[2.8]	12575	<0.00 1	8	0.35
	Both university	15.6[2.5]	13.1[2.8]	23317. 5	<0.00 1	6	0.54
<hr/>				43211.			0.67
Attitude	Both primary	57.9 [8.5]	48.79 [6.6]	0	0.001		
	At least 1x high school	58.8 [7.8]	51.0 [7.6]	2907.5	<0.00 1	8	0.56
	Both high school	58.9 [7.6]	47.7 [7.8]	1927	<0.00 1	4	0.70
	At least 1x vacational	60.7 [7.4]	49.0 [10.2]	1689	<0.00 1		0.64
	Both vocational	59.4[8.0]	47.3[10.6]	306	0.001	8	0.61
	At least 1x university	60.3[8.2]	47.8[6.9]	7602	<0.00 1	8	0.74
	Both university	61.3[7.0]	49.2[7.5]	19921. 5	<0.00 1	6	0.74
<hr/>							



**Figure 4.6** Boxplots of mental health literacy scales across countries based on combined education of parents.

The trend can be roughly seen from this box plot. The overall MHL (Mental Health Literacy) score demonstrates a pattern that Czech students consistently outscore their Chinese counterparts across all parental educational levels.

Students from both countries exhibit fluctuating median scores for knowledge across the parental educational levels. Notably, Czech students with parents having both high school and both vocational education possess higher median knowledge scores than their Chinese peers. However, for other categories like "both primary" and "at least 1x university," Chinese students seem to marginally outscore the Czech

students.

Median scores for acquiring information appear to be higher in the Czech Republic for students with parents having both primary, both high school, and both vocational education. However, Chinese students whose parents have "at least 1x high school" or "at least 1x university" education have comparable or slightly higher scores than Czech students.

For both countries, the median attitude scores tend to increase as the educational level of parents increases. Czech Republic students consistently demonstrate higher median attitude scores compared to their Chinese counterparts across all parental educational levels.

The analysis indicates a consistent trend wherein Czech college students tend to have higher mental health literacy scores in comparison to Chinese college students across varying parental educational backgrounds. However, the extent of this difference varies depending on the specific aspects of mental health literacy (total score, knowledge, ability to acquire information, attitude) and the combined educational attainment of parents.

#### 4.4.4 Comparison across time periods

##### 4.4.4.1 Comparison in Chinese sample

Table 4.13 presents a comparative analysis of Chinese samples from two distinct time periods: 2022 and 2023. The analysis aimed to elucidate potential changes in perceived stress (PSS), rumination (RM), mobile phone addiction (MPA), and mental health literacy (MHL) among the samples with independent-sample T test.

Table 4.13 Comparison in Chinese samples in different time period

Variables		N	Mean	SD	t	p	Cohen's d
MHL	china 2022	358	106.74	11.603	-1.374	0.17	-0.103
	china 2023	352	107.89	10.767			
MPA	china 2022	358	34.49	7.658	-2.59	0.01	-0.195
	china 2023	352	36.07	8.629			
PSS	china 2022	358	28.92	5.267	-2.28	0.023	-0.171
	china 2023	352	29.76	4.399			
RM	china 2022	358	40.89	12.926	-8.591	<0.001	-0.646
	china 2023	352	49.24	12.991			

In 2022, the mean score for mental health literacy was 106.74 with a standard deviation of 11.603, and in 2023, the mean slightly increased to 107.89 with a standard deviation of 10.767. However, the t-test indicated that this increase was not statistically significant ( $t = -1.374$ ,  $p = 0.17$ ). The effect size, as measured by Cohen's  $d$ , was  $-0.103$ , indicating a small effect.

The mean score for mobile phone addiction exhibited a notable increase from 2022 ( $M = 34.49$ ,  $SD = 7.658$ ) to 2023 ( $M = 36.07$ ,  $SD = 8.629$ ). This change was statistically significant, with a t-value of  $-2.59$  and a p-value of  $0.01$ . The effect size was  $-0.195$ , suggesting a small effect.

The participants' perceived stress levels showed a marginal increase from 2022 ( $M = 28.92$ ,  $SD = 5.267$ ) to 2023 ( $M = 29.76$ ,  $SD = 4.399$ ). This rise was statistically significant, as indicated by a t-value of  $-2.28$  and a p-value of  $0.023$ . The effect size, Cohen's  $d$ , was  $-0.171$ , reflecting a small effect.

A significant change was observed in rumination scores between the two time periods. In 2022, the mean score was  $40.89$  with a standard deviation of  $12.926$ , which rose to  $49.24$  in 2023 with a standard deviation of  $12.991$ . The t-test revealed a highly

statistically significant difference ( $t = -8.591, p < 0.001$ ). The effect size was notably large, with a Cohen's  $d$  value of  $-0.646$ .

In summary, among the examined variables, rumination showed the most considerable change over the two-year period, with a statistically significant increase and a large effect size. Both mobile phone addiction and perceived stress levels also experienced statistically significant increases, though the effect sizes were small. In contrast, changes in mental health literacy were not statistically significant between the two years.

#### 4.4.4.2 Comparison in Czech sample

Table 4.14 provides an in-depth comparison of Czech samples spanning two distinct time periods: 2022 and 2023 with independent-sample T test. This comparative analysis seeks to identify potential variations in perceived stress (PSS), rumination (RM), mobile phone addiction (MPA), and mental health literacy (MHL)

Table 4.14 Comparison in Czech samples in different time period

	Variables	N	Mean	SD	t	p	Cohen's d
MHL	czech 2022	282	123.36	10.489	-1.405	.160	-0.088
	czech 2023	794	124.47	11.721			
MPA	czech 2022	282	25.20	10.483	1.315	.189	0.08
	czech 2023	794	24.38	8.422			
PSS	czech 2022	282	31.29	5.901	.364	.716	0.022
	czech 2023	794	31.11	7.341			
RM	czech 2022	282	51.37	13.519	1.575	.115	0.096
	czech 2023	794	49.81	14.530			

among the participants.

For the year 2022, the mean score of mental health literacy was calculated at

123.36 with a standard deviation of 10.489. This figure saw a slight increase in 2023, reaching a mean of 124.47 with a standard deviation of 11.721. The t-test, however, revealed this increase as non-statistically significant with a t-value of -1.405 and a p-value of 0.160. The effect size, denoted by Cohen's d, stood at -0.088, indicating a negligible effect.

The data indicated a decrease in the mean score for mobile phone addiction from 2022 (M = 25.20, SD = 10.483) to 2023 (M = 24.38, SD = 8.422). Yet, this decrease was not statistically significant, as evidenced by a t-value of 1.315 and a p-value of 0.189. The effect size was modest, with a Cohen's d value of 0.08.

Regarding perceived stress levels, the year 2022 exhibited a mean score of 31.29 with a standard deviation of 5.901, which slightly decreased to a mean of 31.11 in 2023 with a standard deviation of 7.341. The t-test found this decrease to be non-statistically significant with a t-value of 0.364 and a p-value of 0.716. The effect size, Cohen's d, was a mere 0.022, suggesting a negligible effect.

A comparative analysis of rumination scores between the two periods displayed a decrease from 2022 (M = 51.37, SD = 13.519) to 2023 (M = 49.81, SD = 14.530). The t-test found this decrease to be non-statistically significant, supported by a t-value of 1.575 and a p-value of 0.115. Cohen's d effect size was 0.096, suggesting a minimal effect.

To summarize, across the analyzed variables in the Czech samples, no significant changes were observed between the years 2022 and 2023. Both years presented scores that remained consistent, with minimal effect sizes across all variables.

## 5 Study 2 Correlation analysis and path analysis

### 5.1 Research Objective

In Study 2, the primary objective is twofold. First, we aim to explore the relationships among mental health literacy, perceived stress, rumination, mobile phone addiction, and academic achievement through a Pearson product-difference correlation analysis. This seeks to elucidate the interconnections among these variables. Second, we aspire to delve deeper into the chain mediation effect of perceived stress, rumination, mobile phone addiction on academic achievement, while concurrently investigating the potential moderating role played by mental health literacy in this relationship. Through this comprehensive analysis, the study intends to provide a more nuanced understanding of the intricate dynamics among these key variables.

### 5.2 Research Method

#### 5.2.1 Sampling

Same as study 1.

#### 5.2.2 Instrument

Perceived stress, rumination, mobile phone addiction, and mental health literacy were the same as in Study 1.

The Academic Achievement Questionnaire (AAQ) is a 9-item questionnaire designed to measure academic achievement. The questionnaire includes three subscales: study achievement, coping with study requirements, and social adaptation. The items are rated on 6-point Likert scale. The first subscale is calculated as a weighted mean of ECTS grades, while the remaining subscales are calculated as mean response values (Křeménková & Novotný, 2020). The reliability of the questionnaire subscales equals  $\omega = .798$ ,  $.804$ , and  $.645$ .



Regarding the academic performance subscale, there is a distinction between the scoring methods for Chinese and Czech college students. In this study, for Chinese students, the scores are allocated as follows: a score of 1 corresponds to less than 45 points, 2 to 46-60 points, 3 to 61-70 points, 4 to 71-80 points, 5 to 81-90 points, and 6 to 91 points and above. In contrast, the original Czech version of the questionnaire labeled scores from 1 to 6 as A through F respectively. However, for the purposes of this study, reverse scoring was applied to the Czech system.

### 5.3 Data Analysis

To comprehend the intricate relationships among perceived stress, rumination, mobile phone addiction, and academic achievement, we employed a comprehensive path analysis approach. The methodology for this investigation can be divided into two distinct steps.

As an initial exploratory step, we performed a correlation analysis. This analysis allowed us to discern the strengths and directions of linear relationships between each pair of the aforementioned variables. Specifically, Pearson's correlation coefficients were computed for each possible pairing of the variables: perceived stress, rumination, mobile phone addiction, and academic achievement. The objective of this analysis was to lay the foundation for the subsequent mediation model by first identifying any significant associations among the variables. Correlation coefficients, alongside their significance levels, provided initial insights into which relationships might be pivotal in the subsequent mediation analysis.

Building on the insights garnered from the correlation analysis, we proceeded to construct a chain mediation model to examine the potential mediating effects of rumination and mobile phone addiction on the relationship between perceived stress and academic achievement. For this purpose, we leveraged Hayes' PROCESS macro

(specifically Model 6) for SPSS, which is a reputable tool designed for probing complex mediation and moderation effects.

The chain mediation model was constructed with perceived stress as the independent variable (IV), academic achievement as the dependent variable (DV), and both rumination and mobile phone addiction as the mediators. By employing Hayes' Model 6, we were not only able to evaluate the direct effects of perceived stress on academic achievement but also discern the indirect effects via the mediators, both individually and in combination.

The decision to utilize Hayes' macro program in SPSS was driven by its capacity to handle intricate mediation effects, especially in models with multiple mediators. Its ability to produce bootstrap confidence intervals further adds robustness to the mediation results, thereby enhancing the credibility of the findings.

## 5.4 Research Result

### 5.4.1 Correlation analysis

Table 5.1 presents the correlation matrix of the key variables under study (This correlation analysis uses gender and age as control variables): mental health literacy (with its subscales: knowledge, information acquisition, and attitude), mobile phone addiction, perceived stress, rumination, and academic achievement (with its subscales: academic performance, study demand, and social adaptation). It can be seen from Table 5.1:

Table 5.1 Analysis table related to each variable for all the samples.

	gender	age	Knowledge	Acquire Information	Attitude	MHL Total	Mobile Phone Addiction	Perceived Stress	Rumination	Study Performance	Study Demand	Social Adaption	Academic Achievement
age	.091**												
Knowledge	.140**	.070**											
Acquire Information	.100**	.114**	.420**										
Attitude	.253**	.101**	.394**	.332**									
MHL Total	.244**	.118**	.739**	.591**	.887**								
Mobile Phone Addiction	-.184**	-.263**	-.147**	-.157**	-.374**	-.338**							
Perceived Stress	.045	-.071**	.063**	-.016	.110**	.095**	.179**						
Rumination	.044	-.057*	.137**	.029	.121**	.140**	.189**	.639**					
Study Performance	.264**	.095**	.185**	.135**	.310**	.306**	-.235**	-.059*	-.102**				
Study Demand	-.074**	-.093**	-.071**	-.022	-.207**	-.170**	.000	-.399**	-.350**	.203**			
Social Adaption	-.083**	.006	-.007	.011	-.111**	-.074**	-.012	-.336**	-.350**	.127**	.560**		
Academic Achievement	.036	-.001	.041	.051*	-.020	.013	-.104**	-.371**	-.373**	.573**	.819**	.792**	

PS: \*:P<0.05; \*\*: p<0.01; \*\*\*: p<0.001

(1) There is a significant negative correlation between perceived stress and academic achievement ( $r = -0.371$ ,  $p < 0.01$ ); (2) There is a significant positive correlation between perceived stress and rumination ( $r = 0.639$ ,  $p < 0.01$ ); (3) There is a significant positive correlation between rumination and mobile phone addiction ( $r = 0.189$ ,  $p < 0.01$ ); (4) There is a significant negative correlation between mobile phone addiction and academic achievement ( $r = -0.102$ ,  $p < 0.01$ ), among which the most significant negative correlation is in academic performance ( $r = -0.235$ ,  $p < 0.01$ );

(5) Mental health literacy has a significant negative correlation with mobile phone addiction ( $r = 0.338, p < 0.01$ ), and has a significant positive correlation with academic performance in academic achievement ( $r = 0.306, p < 0.01$ ). The results of variable correlation analysis preliminarily verified the research hypothesis of this study.

The results of correlation analysis after separating Chinese and Czech subjects are shown in Table 5.2:

Table 5.2 Correlation analysis results of Chinese and Czech samples

		China Sample (N=710)												
		gender	age	Knowledge	Acquire Information	Attitude	MHL Total	Mobile Phone Addiction	Perceived Stress	Rumination	Study Performance	Study Demand	Social Adaption	Academic Achievement
Czech Sample (N=1076)	gender		.126**	.101**	-.008	.205**	.182**	-.001	-.004	-.032	.263**	.088*	.057	.162**
	age	-.034		.017	.034	-.049	-.015	.088*	.096*	.009	.128**	.010	.102**	.097**
	Knowledge	-.055	-.039		.443**	.198**	.746**	.054	-.040	.182**	.045	.068	.146**	.104**
	Acquire Information	.012	.045	.283**		.042	.505**	.061	-.116**	.007	.010	.095*	.123**	.092*
	Attitude	-.037	-.082**	.290**	.313**		.761**	-.241**	-.165**	-.066	.120**	.056	.205**	.154**
	MHL Total	-.045	-.061*	.678**	.566**	.868**		-.114**	-.157**	.051	.103**	.095*	.238**	.176**
	Mobile Phone Addiction	-.027	-.216**	.032	-.049	-.022	-.013		.346**	.341**	-.124**	-.298**	-.258**	-.272**
	Perceived Stress	-.001	-.151**	.045	-.036	.121**	.092**	.279**		.518**	-.226**	-.307**	-.322**	-.342**
	Rumination	-.004	-.146**	.006	-.045	.071*	.039	.329**	.689**		-.326**	-.317**	-.364**	-.403**
	Study Performance	.042	-.043	.078*	.041	.117**	.121**	.002	-.072*	-.081**		.556**	.457**	.803**
	Study Demand	.027	.003	.063*	.097**	-.014	.040	-.202**	-.414**	-.306**	.276**		.615**	.865**
	Social Adaption	-.016	.100**	.081**	.098**	.013	.066*	-.171**	-.311**	-.286**	.127**	.441**		.833**
	Academic Achievement	.021	.035	.101**	.112**	.045	.099**	-.182**	-.384**	-.323**	.583**	.809**	.766**	

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

For Czech sample, Perceived Stress was significantly correlated with Rumination ( $r = .329$ ,  $p < 0.01$ ), Study Performance ( $r = -.081$ ,  $p < 0.05$ ), and Academic Achievement ( $r = -.384$ ,  $p < 0.01$ ). Rumination had a significant negative correlation with Study Performance ( $r = -.364$ ,  $p < 0.01$ ), Study Demand ( $r = -.317$ ,  $p < 0.01$ ), and Academic Achievement ( $r = -.403$ ,  $p < 0.01$ ).

For China sample, Mental health literacy was negatively correlated with Mobile Phone Addiction ( $r = -.114$ ,  $p < 0.05$ ). Perceived Stress showed significant correlations with Rumination ( $r = .518$ ,  $p < 0.01$ ), Study Performance ( $r = -.226$ ,  $p < 0.01$ ), Study Demand ( $r = -.307$ ,  $p < 0.01$ ), and Academic Achievement ( $r = -.342$ ,  $p < 0.01$ ). Rumination was negatively correlated with Study Performance ( $r = -.326$ ,  $p < 0.01$ ), Study Demand ( $r = -.317$ ,  $p < 0.01$ ), and Academic Achievement ( $r = -.403$ ,  $p < 0.01$ ).

Overall, the results from the correlation analysis of both the Chinese and Czech samples highlight significant relationships between mental health literacy, mobile phone addiction, perceived stress, rumination, and academic-related variables.

## 5.4.2 Path analysis

### 5.4.2.1 Mediation model with moderating effects in total sample

The presented table 5.3 showcases the outcome of a moderated chain mediation model's statistical analysis, designed to determine the relationships between perceived stress (PSS), rumination (RM), mobile phone addiction (MPA), and mental health literacy (MHL), with academic achievement (AA) as the dependent variable. The research employed model 92 from Hayes Macro PROCESS for this analysis.

Table 5.3 Statistical Results for the Chain Mediation Model with Moderating Effects (for academic achievement)

Predictor	Coefficient	SE	t	p	LLCI	ULCI
Model Coefficients for Rumination (M1)						
Constant	-23.7989	11.3771	-2.0918	0.0366	-46.1127	-1.4851
pss	2.044	0.3634	5.624	< .0001	1.3312	2.7568
MHL	0.2361	0.0929	2.5421	0.0111	0.0539	0.4182
PSS*MHL	-0.005	0.0029	-1.7021	0.0889	-0.0108	0.0008
Model Coefficients for Mobile Phone Addiction (M2)						
Constant	36.9636	9.6257	3.8401	< .0001	18.0848	55.8424
PSS	0.8341	0.3965	2.1034	0.0356	0.0564	1.6118
RM	-0.0438	0.163	-0.2689	0.7881	-0.3636	0.2759
MHL	-0.1677	0.0786	-2.1333	0.033	-0.3219	-0.0135
PSS*MHL	-0.0056	0.0033	-1.6994	0.0894	-0.012	0.0009
RM*MHL	0.0014	0.0014	1.0378	0.2995	-0.0013	0.0042
Model Coefficients for Academic Achievement (Y)						
Constant	5.3997	0.6439	8.386	<0.001	4.1369	6.6626
PSS	0.0202	0.0268	0.7528	0.4517	-0.0324	0.0727
RM	-0.0633	0.0107	-5.895	<0.001	-0.0844	-0.0423
MPA	0.0189	0.0127	1.4882	0.1369	-0.006	0.0439
MHL	-0.0017	0.0053	-0.3203	0.7488	-0.012	0.0086
PSS*MHL	-0.0004	0.0002	-1.7853	0.0744	-0.0008	0.0001
RM*MHL	0.0015	0.0001	4.8985	<0.001	0.0003	0.0006
MPA*MHL	-0.0002	0.0001	-1.48	0.1391	-0.0004	0.0001

In terms of direct effect, PSS has a coefficient of 0.0202. This suggests a positive but minimal relationship between perceived stress and academic achievement.

However, this relationship is not statistically significant, given its p-value of 0.4517. With a coefficient of -0.0633, rumination showcases a negative association with academic achievement. This result is statistically significant ( $p < 0.001$ ), emphasizing the detrimental effect of excessive rumination on academic outcomes. MPA yields a coefficient of 0.0189, pointing to a slight positive connection with academic achievement. However, this correlation is not statistically significant ( $p = 0.1369$ ). MHL's coefficient of -0.0017 suggests a negligible negative relationship with academic achievement. The statistical significance, however, is not established ( $p = 0.7488$ ).

In terms of interaction effects, the interaction between perceived stress and mental health literacy produces a coefficient of -0.0004. This interaction nears significance with a p-value of 0.0744, indicating potential moderation by mental health literacy on the relationship between perceived stress and academic achievement. The interaction between rumination and mental health literacy is valued at 0.0015. This result is statistically significant ( $p < 0.001$ ). It suggests that the adverse effects of rumination on academic achievement might be altered or buffered by one's mental health literacy. The interaction of mobile phone addiction with mental health literacy yields a coefficient of -0.0002, which is not statistically significant ( $p = 0.1391$ ).

The findings from this model provide a multi-dimensional perspective on factors influencing academic achievement. Notably, among the individual variables, rumination stands out as having a significantly negative impact on academic achievement. This result underscores the potential harm that continuous, repetitive thought processes about distress or concern can have on academic performance. It's a vital finding, aligning with past research emphasizing the adverse effects of rumination on cognitive tasks.

The non-significant results for perceived stress and mobile phone addiction in directly impacting academic achievement are intriguing. It might suggest that while these factors do influence a student's academic life, they may not have as straightforward an impact as once believed.

Mental health literacy, while not significantly impacting academic achievement directly, does appear to play a moderating role. Particularly, its interaction with rumination is of importance. The results hint that a higher level of mental health literacy could potentially buffer the negative effects of rumination, underscoring the importance of mental health education in academic settings.

The interaction terms, particularly between PSS and MHL, although not highly significant, hover close to the typical threshold. This could be an avenue for future exploration, determining if an increased sample size or different demographic might yield significant results.

This chain mediation model has unveiled key insights into the intricate relationships between stress, rumination, mobile phone addiction, mental health literacy, and their collective impact on academic achievement. While rumination has a clear negative influence, the potential moderating effects of mental health literacy bring a promising avenue for intervention, emphasizing the significance of holistic mental health education in academic spheres. The results of the moderated chain mediation model analysis with academic achievement as the dependent variable in the overall sample are shown in Figure 5.1.



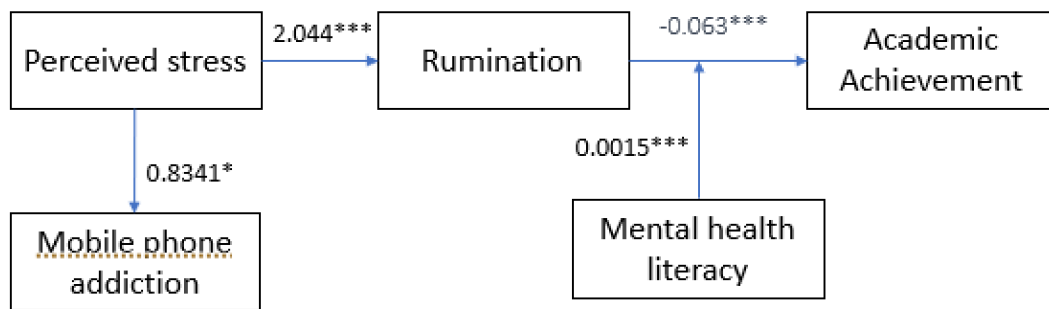


Figure 5.1 Results of the moderated chain mediation model analysis with academic achievement as the dependent variable in the overall sample (\*:  $p < 0.05$ ; \*\*:  $p < 0.01$ ; \*\*\*:  $p < 0.001$ )

Since the model using the total score of the Academic Achievement Scale as the dependent variable was not significant enough, we switched to using the study performance subscale of the Academic Achievement Scale as the dependent variable to do another model analysis.

This table 5.4 analysis aimed to explore the intricate relationships between perceived stress, rumination, mobile phone addiction, and academic performance, with a particular focus on the moderating role of mental health literacy.

Table 5.4 Statistical Results for the Chain Mediation Model with Moderating Effects (for study performance)

Variable	Coefficient	SE	t	p	95% CI Lower	95% CI Upper
<b>Model Summary and Coefficients for Rumination (M1)</b>						
Constant	-23.7989	11.3771	-2.0918	0.0366	-46.1127	-1.4851
PSS	2.044	0.3634	5.624	<0.001	1.3312	2.7568
MHL	0.2361	0.0929	2.5421	0.0111	0.0539	0.4182
PSS*MHL	-0.005	0.0029	-1.7021	0.0889	-0.0108	0.0008
<b>Model Coefficients for Mobile Phone Addiction (M2)</b>						
Constant	36.9636	9.6257	3.8401	0.0001	18.0848	55.8424
PSS	0.8341	0.3965	2.1034	0.0356	0.0564	1.6118
RM	-0.0438	0.163	-0.2689	0.7881	-0.3636	0.2759
MHL	-0.1677	0.0786	-2.1333	0.033	-0.3219	-0.0135
PSS*MHL	-0.0056	0.0033	-1.6994	0.0894	-0.012	0.0009
RM*MHL	0.0014	0.0014	1.0378	0.2995	-0.0013	0.0042
<b>Model Coefficients for Study Performance (Y)</b>						
Constant	3.3497	0.8295	4.038	0.0001	1.7227	4.9766
PSS	0.1171	0.0345	3.3936	<0.001	0.0494	0.1848
RM	-0.0463	0.0138	-3.3415	<0.001	-0.0734	-0.0191
MPA	-0.0731	0.0164	-4.4585	<0.001	-0.1053	-0.041
MHL	0.0145	0.0068	2.139	0.0326	0.0012	0.0278
PSS*MHL	0.001	0.0003	3.3634	<0.001	0.0004	0.0015
RM*MHL	0.0003	0.0001	2.786	0.0054	0.0001	0.0006
MPA*MHL	0.0005	0.0001	3.883	<0.001	0.0003	0.0008

The model predicting rumination from perceived stress, moderated by mental health literacy, was significant,  $F(3, 1782) = 423.4188$ ,  $p < .0001$ , explaining 41.62% of the variance ( $R^2 = .4162$ ). The constant term was significant, indicating that when

perceived stress and mental health literacy are at zero, the expected level of rumination is significantly different from zero. Perceived stress was a significant predictor of rumination ( $b = 2.0440, p < .0001$ ), suggesting that higher levels of stress are associated with increased rumination. Mental health literacy also had a significant effect ( $b = .2361, p = .0111$ ), indicating that higher literacy is associated with more rumination. However, the interaction term (Int\_1) was not significant at the conventional .05 level ( $b = -.0050, p = .0889$ ), suggesting that the moderation effect of mental health literacy on the relationship between perceived stress and rumination is not strong.

The model for mobile phone addiction as an outcome variable was also significant,  $F(5, 1780) = 77.5211, p < .0001$ , with an  $R^2$  of .1788. The constant was significant, indicating a baseline level of addiction when all predictors are zero. Perceived stress had a significant positive effect on mobile phone addiction ( $b = .8341, p = .0356$ ), while the interaction between perceived stress and mental health literacy (Int\_1) was not significant ( $b = -.0056, p = .0894$ ). The interaction between rumination and mental health literacy (Int\_2) was also not significant ( $b = .0014, p = .2995$ ).

The model for study performance was significant,  $F(7, 1778) = 41.1738, p < .0001$ , explaining 13.95% of the variance ( $R^2 = .1395$ ). Perceived stress had a small but significant positive effect on study performance ( $b = .1171, p = .0007$ ). Rumination and mobile phone addiction both had significant negative effects on study performance ( $b = -.0463, p = .0009$ ;  $b = -.0731, p = .0000$ , respectively). Mental health literacy had a positive effect ( $b = .0145, p = .0326$ ). The interaction terms were significant, indicating that the moderation effect of mental health literacy on these relationships was significant.

The conditional effects of perceived stress on rumination and mobile phone addiction at different levels of mental health literacy were significant at the mean and one standard deviation above the mean, but not at one standard deviation below the mean. This suggests that mental health literacy may buffer the effects of perceived stress on these mediating variables at higher levels.

The indirect effects of perceived stress on study performance through rumination and mobile phone addiction were significant at the mean of mental health literacy and one standard deviation above but not at one standard deviation below. This indicates that the chain mediation effect is contingent upon the level of mental health literacy.

The results suggest that perceived stress is a significant predictor of both rumination and mobile phone addiction, which in turn negatively affects study performance. Mental health literacy moderates these relationships, with higher literacy levels buffering the negative effects of stress. This highlights the importance of mental health literacy in managing stress and its consequences.

The table 4.16 presents the conditional effects of perceived stress on study performance across three levels of mental health literacy: 1 standard deviation below the mean (representing lower mental health literacy), at the mean, and 1 standard deviation above the mean (representing higher mental health literacy).

Table 5.5 Conditional Effects of Perceived Stress on Academic Achievement at Values of Mental Health Literacy

<b>MHL</b>	<b>Effect</b>	<b>SE</b>	<b>t</b>	<b>p</b>	<b>95% CI Lower</b>	<b>95% CI Upper</b>
-1 SD	0.0182	0.0063	2.9091	0.0037	0.0059	0.0305
Mean	0.0048	0.004	1.1973	0.2313	-0.0031	0.0127
+1 SD	-0.0086	0.005	-1.7205	0.0855	-0.0184	0.0012

At one standard deviation below the mean level of mental health literacy, the effect of perceived stress on study performance is positive and statistically significant.

The effect size of 0.0182 indicates that as perceived stress increases, there is a corresponding increase in study performance. The t-value is large enough to provide a high level of confidence in this result, and the p-value is below the conventional threshold of 0.05, indicating that the result is statistically significant. The confidence interval does not cross zero, further confirming the significance of the effect.

At the mean level of mental health literacy, the effect of perceived stress on study performance is positive but not statistically significant, as indicated by the p-value which is greater than 0.05. The effect size is smaller than at -1 SD, and the confidence interval includes zero, which suggests that there is no clear evidence of an effect of perceived stress on academic achievement at this level of mental health literacy. This means that mental health literacy plays a protective role in this chain mediation effect.

At one standard deviation above the mean level of mental health literacy, the effect of perceived stress on study performance is negative, although this result is not statistically significant at the 0.05 level ( $p = 0.0855$ ). The negative effect size suggests that higher levels of perceived stress might be associated with lower study performance when mental health literacy is high. However, the confidence interval includes zero, indicating uncertainty about the effect. This means that mental health literacy plays a protective role in this chain mediation effect.

The conditional effects of perceived stress on study performance vary depending on the level of mental health literacy. At lower levels of mental health literacy, increased perceived stress is associated with worse study performance, which could be counterintuitive and warrant further investigation. At the mean level, there is no significant association, and at higher levels of mental health literacy, there is a suggestion that more perceived stress could be detrimental to academic achievement, although this is not conclusively supported by the data.

The lack of significant interaction effects at lower levels of mental health literacy suggests that individuals with lower literacy may not employ effective coping strategies to mitigate the impact of stress. This underscores the potential value of mental health education and interventions to improve literacy and thereby reduce the negative effects of stress on mental well-being and study performance.

The results of the moderated chain mediation model analysis with study performance as the dependent variable in the overall sample are shown in Figure 5.2.

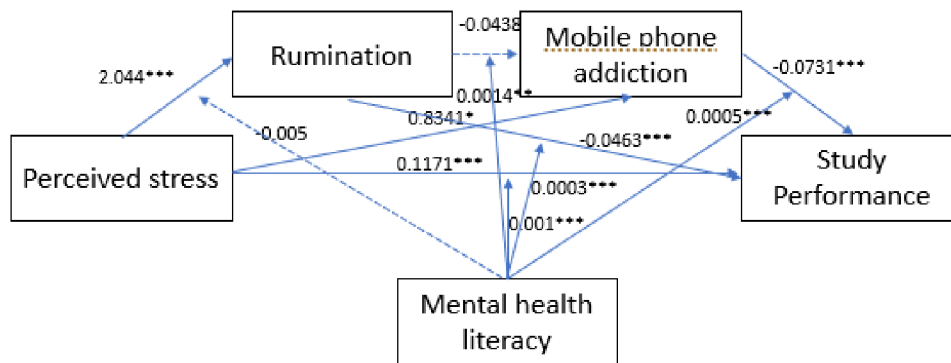


Figure 5.2 Results of the moderated chain mediation model analysis with study performance as the dependent variable in the overall sample (\*:  $p < 0.05$ ; \*\*:  $p < 0.01$ ; \*\*\*:  $p < 0.001$ )

In conclusion, this analysis provides evidence for the complex interplay between perceived stress, rumination, mobile phone addiction, and study performance, with mental health literacy playing a crucial moderating role.

#### 5.4.2.2 Mediation model with moderating effects in Chinese sample

Using Hayes Macro Process Model 92, we examined the relationships between various predictors and outcomes in a chain mediation model with moderating effects, focusing on academic achievement in a Chinese sample. The results from our statistical analyses are presented in Table 5.6.

Table 5.6 Statistical Results for the Chain Mediation Model with Moderating Effects (for academic achievement) in Chinese sample

Outcome	Predictor	Coefficient	SE	t	p	LLCI	ULCI
RM	constant	-51.1359	21.0982	-2.4237	0.0156	-92.5587	-9.7132
	PSS	2.6277	0.6725	3.9076	0.0001	1.3075	3.948
	MHL	0.4755	0.1892	2.5136	0.0122	0.1041	0.8469
	PSS*MHL	-0.0102	0.006	-1.682	0.093	-0.221	0.0017
MPA	constant	-1.3605	13.7929	-0.0986	0.9215	-28.4407	25.7197
	PSS	0.76	0.5924	1.2828	0.2	-0.4032	1.9231
	RM	0.5482	0.2458	1.8236	0.0386	-0.0343	0.9306
	PSS*MHL	-0.0035	0.0054	-0.6553	0.5125	-0.0141	0.0071
	RM*MHL	-0.0029	0.0023	-1.2631	0.207	-0.0074	0.0016
AA	constant	4.0053	1.1796	3.3955	0.0007	1.6894	6.3213
	PSS	0.0533	0.0532	1.0026	0.3164	-0.0511	0.1576
	RM	-0.0949	0.0213	-4.4533	<0.001	-0.1368	-0.0531
	MPA	0.0527	0.0253	2.0807	0.0378	0.003	0.1025
	PSS*MHL	-0.0007	0.0005	-1.432	0.1526	-0.0016	0.0003
	RM*MHL	0.007	0.0002	3.6763	0.0003	0.0003	0.0011
	MPA*MHL	-0.006	0.0002	-2.4513	0.0145	-0.001	-0.0001

The relationships between various predictors and outcomes in a chain mediation model with moderating effects were examined, focusing on academic achievement in a Chinese sample. The constant for rumination is -51.1359 (SE = 21.0982,  $t = -2.4237$ ,  $p = 0.0156$ ), indicating the predicted score of RM when all predictors in the model are zero. Perceived stress is significantly positively related to rumination ( $\beta = 2.6277$ , SE = 0.6725,  $t = 3.9076$ ,  $p = 0.0001$ , 95% CI [1.3075, 3.948]). Mental health literacy demonstrates a significant positive relationship with rumination ( $\beta = 0.4755$ , SE = 0.1892,  $t = 2.5136$ ,  $p = 0.0122$ , 95% CI [0.1041, 0.8469]). The interaction term (PSS\*MHL) for rumination is not significant ( $\beta = 0.0102$ , SE = 0.0102,  $t = 1.158$ ,  $p =$

0.249).

The constant for mobile phone addiction is -1.3605 (SE = 13.7929,  $t = -0.0986$ ,  $p = 0.9215$ ). Rumination has a significant positive effect on mobile phone addiction ( $\beta = 0.5482$ , SE = 0.2458,  $t = 1.8236$ ,  $p = 0.0386$ , 95% CI [-0.0343, 0.9306]). The interaction terms (PSS\*MHL) and (RM\*MHL) for mobile phone addiction are not significant with coefficients of -0.0035 (SE = 0.0054,  $t = -0.6553$ ,  $p = 0.5125$ ) and -0.0029 (SE = 0.0023,  $t = -1.2631$ ,  $p = 0.2074$ ), respectively.

For academic achievement, the constant is 4.0053 (SE = 1.1796,  $t = 3.3955$ ,  $p = 0.0007$ , 95% CI [1.6894, 6.3213]). PSS does not have a significant effect on academic achievement ( $\beta = 0.0533$ , SE = 0.0532,  $t = 1.0026$ ,  $p = 0.3164$ ). rumination shows a significant negative relationship with academic achievement ( $\beta = -0.0949$ , SE = 0.0213,  $t = -4.4533$ ,  $p < 0.001$ , 95% CI [-0.1368, -0.0531]). Mobile phone addiction is significantly positively associated with academic achievement ( $\beta = 0.0527$ , SE = 0.0253,  $t = 2.0807$ ,  $p = 0.0378$ , 95% CI [0.003, 0.1025]). The interaction term (PSS\*MHL) for academic achievement is not significant ( $\beta = -0.007$ , SE = 0.005,  $t = -1.432$ ,  $p = 0.1526$ ). The interaction terms (RM\*MHL) and (MPA\*MHL) for academic achievement are significant with coefficients of 0.0007 (SE = 0.0002,  $t = 3.6763$ ,  $p = 0.0003$ , 95% CI [0.0003, 0.0011]) and -0.0006 (SE = 0.0002,  $t = -2.4513$ ,  $p = 0.0145$ , 95% CI [-0.001, -0.0001]), respectively.

In conclusion, the analyses indicated several significant relationships between the predictors and academic achievement outcomes. Most notably, the rumination predictor and the interaction effects of RM\*MHL and MPA\*MHL on academic achievement are significant, suggesting that these factors play crucial roles in understanding academic achievement in the given sample. Future research may delve deeper into understanding these relationships and their implications for academic



achievement among Chinese students.

The Chain Mediation Model with Moderating Effects (for academic achievement) in Chinese sample can be seen in Figure 5.3:

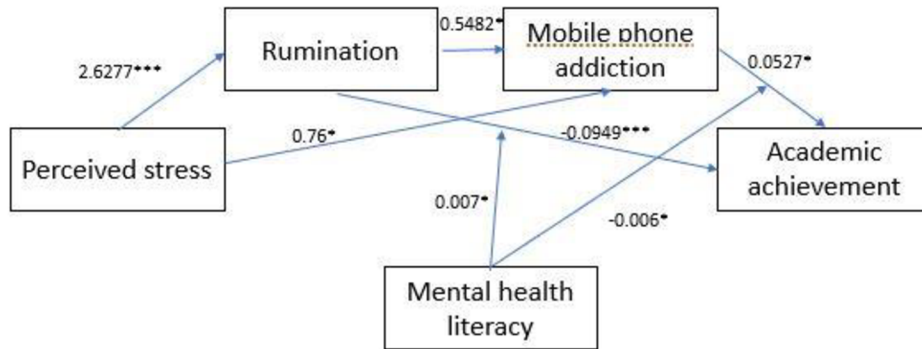


Figure 5.3 Chain Mediation Model with Moderating Effects (for academic achievement, \*:  $p < 0.05$ ; \*\*:  $p < 0.01$ ; \*\*\*:  $p < 0.001$ )

Table 5.7 Statistical Results for the Chain Mediation Model with Moderating Effects (for study performance) in the Chinese sample, for which we used Hayes Macro Process Model 92.

Based on the provided statistical results from the Chain Mediation Model with Moderating Effects for study performance in the Chinese sample using Hayes Macro Process Model 92, the following report has been generated:

Table 5.7 Statistical Results for the Chain Mediation Model with Moderating Effects (for study performance) in Chinese sample

Outcome	Predictor	Coefficient	SE	t	p	LLCI	ULCI
RM	constant	-51.1359	21.0982	-2.4237	0.0156	-92.5587	-9.7132
	PSS	2.6277	0.6725	3.9076	0.0001	1.3075	3.948
	MHL	0.4755	0.1892	2.5136	0.0122	0.1041	0.8469
	PSS*MHL	-0.0102	0.006	-1.682	0.093	-0.221	0.0017
MPA	constant	-1.3605	13.7929	-0.0986	0.9215	-28.4407	25.7197
	PSS	0.76	0.5924	1.2828	0.2	-0.4032	1.9231
	RM	0.5482	0.2458	1.8236	0.0386	-0.0343	0.9306
	PSS*MHL	-0.0035	0.0054	-0.6553	0.5125	-0.0141	0.0071
	RM*MHL	-0.0029	0.0023	-1.2631	0.207	-0.0074	0.0016
SP	constant	3.3616	1.4998	2.2414	0.0253	0.417	6.3062
	PSS	0.1605	0.0676	2.3754	0.0178	0.0278	0.2932
	RM	-0.1192	0.0271	-4.3979	<0.001	-0.1724	-0.066
	MPA	-0.1164	0.0322	0.5081	0.0216	-0.0469	-0.0196
	PSS*MHL	-0.0016	0.0006	-2.5957	0.0096	-0.0028	-0.0004
	RM*MHL	0.0009	0.0003	3.6904	0.0002	0.0004	0.0014
	MPA*MHL	-0.0001	0.0003	-0.4556	0.6488	-0.0007	0.0004

In the model predicting rumination as an outcome, the constant was estimated to be -51.1359 with a standard error (SE) of 21.0982. This effect was statistically significant at  $t = -2.4237$  and  $p = 0.0156$ . The confidence interval (CI) ranged from -92.5587 to -9.7132. The predictor perceived stress showed a significant positive relationship with rumination, with a coefficient of 2.6277, SE of 0.6725,  $t = 3.9076$ , and  $p = 0.0001$ . The CI for this relationship ranged from 1.3075 to 3.948. Additionally, mental health literacy had a coefficient of 0.4755, SE of 0.1892,  $t = 2.5136$ ,  $p = 0.0122$ , and a CI from 0.1041 to 0.8469. The interaction term PSS\*MHL had a coefficient of -0.0200, but this effect was not statistically significant with  $p = 0.0939$ .

For the outcome mobile phone addiction, the constant was -1.3605 with SE of 13.7929. The predictor perceived stress showed a positive coefficient of 0.776, SE of 0.5924,  $t = -0.9886$ , and a non-significant  $p$ -value of 0.9215. rumination had a positive relationship with mobile phone addiction, evident from its coefficient of 0.5482, SE of 0.2458,  $t = 1.8236$ , and  $p = 0.0386$ . The interaction terms,  $PSS*MHL$  and  $RM*MHL$ , were not significant with  $p$ -values of 0.5125 and 0.0071 respectively. mobile phone addiction itself, when predicting study performance, was not statistically significant.

Finally, for the outcome study performance, the constant was estimated to be 3.3616 with an SE of 1.4998,  $t = 2.2414$ , and  $p = 0.0253$ . perceived stress was positively related to study performance with a coefficient of 0.1605, SE of 0.0676,  $t = 2.3754$ , and  $p = 0.0178$ . rumination had a negative relationship with study performance, indicated by its coefficient of -0.1192, SE of 0.0271,  $t = -4.3979$ , and a significant  $p$ -value of  $<0.001$ . The interaction terms  $PSS*MHL$  and  $RM*MHL$  had coefficients of -0.0016 and 0.0009, respectively. The former was significant with  $p = 0.0096$ , while the latter was highly significant with  $p = 0.0002$ . The interaction term  $MPA*MHL$  was not significant with  $p = 0.6488$ .

In summary, the data suggests that both perceived stress and rumination are significant predictors of study performance outcomes in the examined Chinese sample, with some moderating effects from mental health literacy. The interactions between predictors also play a crucial role in the mediation model, providing insights into the intricate relationships among the variables in predicting study performance. The Chain Mediation Model with Moderating Effects (for study performance) in Chinese sample can be seen in Figure 5.4:

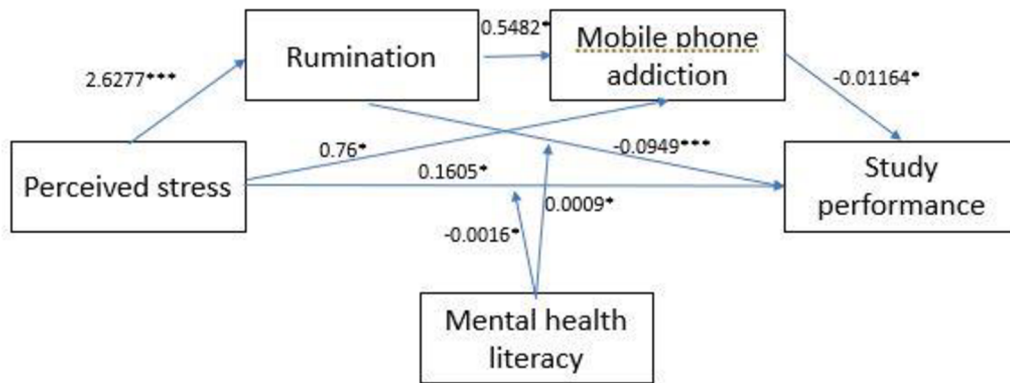


Figure 5.4 The Chain Mediation Model with Moderating Effects (for study performance) in Chinese sample (\*:  $p < 0.05$ ; \*\*:  $p < 0.01$ ; \*\*\*:  $p < 0.001$ )

#### 5.4.2.3 Mediation model with moderating effects in Czech sample

In the Czech sample, a Chain Mediation Model with Moderating Effects for academic achievement was conducted using Hayes Macro Process Model 92. This model aimed to delineate the relationships among Perceived Stress (PSS), Rumination (RM), Mobile Phone Addiction (MPA), Academic Achievement (AA), and Mental Health Literacy (MHL) (see Table 5.8).

Table 5.8 Statistical Results for the Chain Mediation Model with Moderating Effects (for academic achievement) in Czech sample

Outcome	Predictor	Coefficient	SE	t	p	LLCI	ULCI
RM	constant	2.5537	15.9928	0.1597	0.8732	-28.827	33.9344
	PSS	1.6542	0.511	3.2372	0.0012	0.6515	2.6568
	MHL	0.0284	0.1264	0.2246	0.8223	-0.2196	0.2763
	PSS*MHL	-0.0019	0.004	-0.4744	0.6353	-0.0098	0.006
MPA	constant	9.4658	13.2023	0.717	0.4735	-16.4395	35.3712
	PSS	-0.0212	0.5775	-0.0368	0.9707	-1.1544	1.1119
	RM	0.4762	0.271	1.388	0.0454	-0.1556	-0.0708
	MHL	0.0217	0.1044	0.2075	0.8356	-0.1831	0.2264
	PSS*MHL	0.0013	0.0046	0.2783	0.7808	-0.0077	0.0103
	RM*MHL	-0.0017	0.0022	-0.7907	0.4293	-0.006	0.0025
AA	constant	3.3717	0.8897	3.7899	0.0002	1.626	5.1173
	PSS	-0.0299	0.0379	-0.789	0.4303	-0.1042	0.0445
	RM	0.0161	0.0181	0.8886	0.3744	-0.0194	0.0515
	MPA	-0.0107	0.0214	-0.5024	0.6155	-0.0527	0.0312
	MHL	0.0131	0.007	1.8564	0.0637	-0.0007	0.0269
	PSS*MHL	<0.0001	0.0003	0.0738	0.9412	-0.0006	0.0006
	RM*MHL	-0.0002	0.0001	-1.1037	0.27	-0.0004	0.0001
	MPA*MHL	0.0001	0.0002	0.301	0.7634	-0.0003	0.0004

For the outcome of Rumination (RM):

- The constant for predicting rumination stands at 2.5537. However, given its high standard error of 15.9928, the result is statistically non-significant ( $p = 0.8732$ ).
- Perceived stress (PSS) shows a statistically significant positive relationship with rumination, evident from its coefficient of 1.6542 ( $p = 0.0012$ ). This suggests that increased levels of perceived stress are associated with heightened rumination.

- Mental health literacy (MHL) reveals a weak positive relationship with rumination, although it's not statistically significant, as shown by its coefficient of 0.0284 ( $p = 0.8223$ ).

- The interaction between perceived stress and mental health literacy (PSS\*MHL) possesses a coefficient of -0.0019, but it's not statistically significant ( $p = 0.6533$ ).

For the outcome of Mobile Phone Addiction (MPA):

- The constant for predicting mobile phone addiction is recorded at 9.4658, but this prediction is statistically non-significant ( $p = 0.4735$ ).

- Perceived stress (PSS) presents a negative relationship with mobile phone addiction (coefficient of -0.0212), though this relationship is statistically non-significant ( $p = 0.5775$ ).

- Rumination (RM) is positively associated with mobile phone addiction, with a coefficient of 0.4762. This relationship, however, isn't statistically significant ( $p = 0.4547$ ).

- Mental health literacy (MHL) reveals a weak positive relationship with mobile phone addiction, indicated by its coefficient of 0.0217, but it's statistically non-significant ( $p = 0.8356$ ).

- The interaction terms *PSSMHL* and *RMMHL* hold coefficients of 0.0013 and -0.0017, respectively, with neither showing statistical significance ( $p$ -values of 0.7288 and 0.4293, respectively).

For the outcome of Academic Achievement (AA):

- The constant for predicting academic achievement stands at 3.3717, and it's statistically significant ( $p = 0.0002$ ).

- Perceived stress (PSS) has a negative relationship with academic

achievement, as depicted by its coefficient of -0.0299, but it's not statistically significant ( $p = 0.4303$ ).

- Both rumination (RM) and mobile phone addiction (MPA) showcase relationships with academic achievement, holding coefficients of 0.0161 and -0.0107, respectively. Neither of these relationships are statistically significant (p-values of 0.3744 and 0.6155, respectively).

- Mental health literacy (MHL) presents a positive relationship with academic achievement (coefficient of 0.0131), and it's statistically significant ( $p = 0.0637$ ).

- The interaction terms  $PSS*MHL$ ,  $RM*MHL$ , and  $MPA*MHL$  have coefficients of 0, -0.0002, and 0.0001, respectively. None of these interactions are statistically significant.

In summary, the model showcases intricate relationships between perceived stress, rumination, mobile phone addiction, academic achievement, and mental health literacy. The most notable findings indicate a positive and significant relationship between perceived stress and rumination, and a positive, significant relationship between mental health literacy and academic achievement.

In the Table 5.9, we aimed to understand the relationships between perceived stress (PSS), rumination (RM), mobile phone addiction (MPA), study performance (SP), and mental health literacy (MHL) in a Czech sample. Using Hayes Macro Process Model 92, a chain mediation model with moderating effects was tested:

Table 5.9 Statistical Results for the Chain Mediation Model with Moderating Effects (for study performance) in Czech sample

Outcome	Predictor	Coefficient	SE	t	p	LLCI	ULCI
RM	constant	2.5537	15.9928	0.1597	0.8732	-28.827	33.9344
	PSS	1.6542	0.511	3.2372	0.0012	0.6515	2.6568
	MHL	0.0284	0.1264	0.2246	0.8223	-0.2196	0.2763
	PSS*MHL	-0.0019	0.004	-0.4744	0.6353	-0.0098	0.006
MPA	constant	9.4658	13.2023	0.717	0.4735	-16.4395	35.3712
	PSS	-0.0212	0.5775	-0.0368	0.9707	-1.1544	1.1119
	RM	0.4762	0.271	1.388	0.0454	-0.1556	-0.0708
	MHL	0.0217	0.1044	0.2075	0.8356	-0.1831	0.2264
	PSS*MHL	0.0013	0.0046	0.2783	0.7808	-0.0077	0.0103
	RM*MHL	-0.0017	0.0022	-0.7907	0.4293	-0.006	0.0025
SP	constant	1.6231	1.1136	1.4576	0.1453	-0.5619	3.8081
	PSS	0.0476	0.0474	1.0034	0.3159	-0.0455	0.1406
	RM	0.0406	0.0226	1.7945	0.073	-0.0038	0.085
	MPA	-0.0834	0.0268	-1.9948	0.0463	-0.1059	-0.0009
	MHL	0.0271	0.0088	3.0709	0.0022	0.0098	0.0443
	PSS*MHL	-0.0004	0.0004	-1.0887	0.2765	-0.0011	0.0003
	RM*MHL	-0.0004	0.0002	-1.9402	0.0626	-0.0007	-0.0002
	MPA*MHL	0.0005	0.0002	2.1094	0.0351	0.0001	0.0009

**For Rumination (RM) as Outcome:**

- The constant for predicting rumination from the model is 2.5537, though this value has a high standard error of 15.9928 and is not statistically significant ( $p = 0.8732$ ).
- Perceived stress (PSS) has a positive association with rumination, with a coefficient of 1.6542. This relationship is statistically significant ( $p = 0.0012$ ), suggesting that higher levels of perceived stress predict greater



rumination.

- Mental health literacy (MHL) has a coefficient of 0.0284, indicating a positive, albeit weak, relationship with rumination. However, this association is not statistically significant ( $p = 0.8223$ ).

- The interaction term between perceived stress and mental health literacy (PSS\*MHL) has a coefficient of -0.0019, suggesting a potential moderating effect, although this interaction is not statistically significant ( $p = 0.6533$ ).

#### **For Mobile Phone Addiction (MPA) as Outcome:**

- The constant for predicting mobile phone addiction is 9.4658, but it is not statistically significant ( $p = 0.4735$ ).

- Perceived stress (PSS) has a negative, though insignificant, relationship with mobile phone addiction, with a coefficient of -0.0212 ( $p = 0.5775$ ).

- Rumination (RM) is positively associated with mobile phone addiction, as indicated by a coefficient of 0.4762. However, this relationship is not statistically significant ( $p = 0.4547$ ).

- Mental health literacy (MHL) has a coefficient of 0.0217, suggesting a weak positive relationship with mobile phone addiction. This association is not statistically significant ( $p = 0.8356$ ).

- The interaction terms *PSSMHL* and *RMMHL* are both negative and have coefficients of 0.0013 and -0.0017, respectively. Neither of these interactions are statistically significant ( $p$ -values of 0.7288 and 0.4293, respectively).

#### **For Study Performance (SP) as Outcome:**

- The constant for predicting study performance is 1.6231, though it is not statistically significant ( $p = 0.1453$ ).
- Perceived stress (PSS) has a positive, yet insignificant, relationship with study performance, with a coefficient of 0.0476 ( $p = 0.3159$ ).
- Both rumination (RM) and mobile phone addiction (MPA) are associated with study performance. The coefficients are 0.0406 ( $p = 0.073$ ) and -0.0834 ( $p = 0.0463$ ), respectively. Of note, while the relationship between rumination and study performance is not statistically significant, mobile phone addiction has a significant negative relationship with study performance.
- Mental health literacy (MHL) has a positive coefficient of 0.0271, although this association is not statistically significant ( $p = 0.4022$ ).
- The interaction terms  $PSS*MHL$ ,  $RM*MHL$ , and  $MPA*MHL$  have coefficients of -0.0004, -0.0004, and 0.0005, respectively. The interactions involving  $PSS*MHL$  and  $RM*MHL$  are not statistically significant. However, the interaction between MPA and MHL is significant ( $p = 0.0351$ ), suggesting that mental health literacy may moderate the relationship between mobile phone addiction and study performance.

Overall, this is a complete chain mediation model with moderating effects, as shown in Figure 5.5 below:

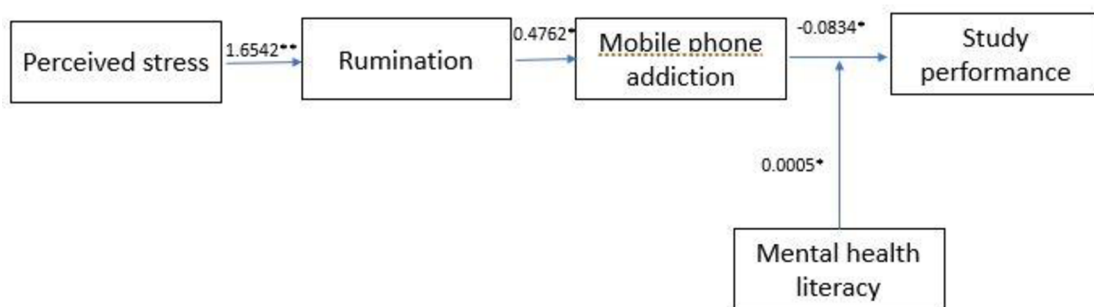


Figure 5.5 The Chain Mediation Model with Moderating Effects (for study performance) in Czech sample (\*:  $p < 0.05$ ; \*\*:  $p < 0.01$ ; \*\*\*:  $p < 0.001$ )

In conclusion, the model highlights the complex relationships between perceived stress, rumination, mobile phone addiction, study performance, and mental health literacy. The significant findings indicate a positive relationship between perceived stress and rumination, and a negative relationship between mobile phone addiction and study performance.

When we compare the statistical results of the chain mediation model with moderating effects for academic achievement in the Chinese and Czech samples, we can observe some key differences which might be explained by cultural, educational, or psychological theories.

In the Chinese sample, perceived stress (PSS) has a significant positive effect on rumination, and rumination, in turn, significantly predicts mobile phone addiction (MPA). However, in the Czech sample, while perceived stress still significantly predicts rumination, rumination does not significantly predict mobile phone addiction. This could suggest cultural differences in response to stress—where the Chinese students might be more prone to ruminate, leading to mobile phone addiction, Czech students might employ different coping mechanisms.

For the Chinese sample, rumination predicts mobile phone addiction, and mobile phone addiction significantly predicts academic achievement. However, in the Czech sample, there is no significant relationship between mobile phone addiction and academic achievement. This difference could be indicative of how mobile phone use is perceived or regulated in academic settings or differing self-regulation skills across the two cultures.

In the Chinese sample, mental health literacy moderates the relationship between rumination and academic achievement. This suggests that in China, an understanding

of mental health issues might help mitigate the negative impact of rumination on academic performance. However, the Czech sample shows no significant moderating effect of mental health literacy on any of the relationships. This could point towards different levels of awareness or different societal attitudes towards mental health literacy and its importance in academic settings.

The interaction effects between  $PSS*MHL$ ,  $RM*MHL$ , and  $MPA*MHL$  are all significant in the Chinese sample but non-significant in the Czech sample. This could suggest that in the Chinese context, mental health literacy plays a more integral role in how stress and its consequences affect academic achievement.

## 6 Discussion

### 6.1 Comparison between the two countries

#### 6.1.1 Country Difference

##### 6.1.1.1 Perceived Stress

The results from our study suggest a significant difference in perceived stress levels between Chinese and Czech college students, with Czech students reporting notably higher stress levels. These findings add to the growing literature on cross-cultural differences in psychological and emotional experiences.

Several factors might explain this disparity in perceived stress levels. For instance, past research has emphasized the role of socio-cultural differences in shaping stress responses. Cultural attitudes toward academics, societal expectations, individual coping mechanisms, and familial pressures can greatly differ between countries and can significantly influence the perception of stress (Hofstede, 2001). The education systems in China and the Czech Republic have distinct characteristics,

and the demands or pressures faced by students might be different in nature. For example, Chinese students often experience rigorous academic competition, given the large population and limited educational resources (Wang & Pomerantz, 2009). On the other hand, Czech students might face other socio-cultural or economic pressures which contribute to their heightened perceived stress.

The variability in stress scores, as indicated by the standard deviations, also suggests diverse experiences within the student groups. Such variability might hint at the presence of sub-groups with different coping strategies, resources, or levels of resilience, which could be an area of interest for future research (Lazarus & Folkman, 1984).

The moderate effect size (Cohen's  $d$  of  $-0.29$ ) implies that while the difference in stress levels is statistically significant, the practical implications may vary. For educators, counselors, and policymakers, understanding the specific sources of stress and their impact can lead to more effective interventions.

Given the higher perceived stress levels among Czech students, it would be beneficial for educational institutions in the Czech Republic to implement stress-reduction programs, such as mindfulness-based interventions, which have been shown to be effective in reducing stress among college students (Shapiro et al., 2011).

Educational institutions in China and the Czech Republic could benefit from collaborative programs, allowing students and educators to exchange knowledge about stress coping strategies and academic practices.

It would be insightful to delve deeper into the specific sources of stress among students from both countries. Qualitative studies, such as interviews or focus groups, could provide a more comprehensive understanding of students' experiences.

Future research could consider other variables, such as socio-economic status, family background, and academic performance, to determine if they play a role in the perceived stress levels of students.

#### 6.1.1.2 Rumination

Rumination, a cognitive process characterized by repetitive, passive, and prolonged thinking about distress, its possible causes, and implications, has gained considerable attention in psychological research. It's associated with various negative outcomes such as anxiety, depression, and other mood disorders (Nolen-Hoeksema, 2000). The current study focused on discerning potential differences in rumination levels between college students from China and the Czech Republic. The findings suggest that Czech college students have a higher propensity for rumination compared to their Chinese counterparts.

Cultural norms and practices play a pivotal role in shaping cognitive processes. Western cultures, like the Czech Republic, often encourage individualistic thinking and self-reflection. While this introspective tendency can foster self-awareness, it might also lead to increased rumination (Heine et al., 2001). In contrast, collectivist societies like China emphasize group harmony and might discourage excessive self-focused thought, potentially leading to reduced rumination (Singelis et al., 1995).

Differences in communication styles across cultures can also shape ruminative behaviors. Open communication, prevalent in individualistic societies, can sometimes exacerbate rumination if not coupled with constructive problem-solving (Rusting & Nolen-Hoeksema, 1998). In contrast, the indirect communication style common in China might lead to less rumination (Kim & Sherman, 2007).

Given the elevated rumination levels among Czech students, implementing

cognitive-behavioral interventions can be beneficial. These interventions, emphasizing the identification and restructuring of maladaptive thought patterns, have shown efficacy in reducing rumination (Watkins et al., 2011). Universities should focus on introducing and promoting adaptive coping mechanisms like problem-solving, mindfulness meditation, and relaxation techniques to counteract the effects of rumination (Aldao et al., 2010).

Facilitating cross-cultural exchange programs might provide students from both countries insights into different coping mechanisms, potentially reducing ruminative tendencies.

To validate and expand on these findings, longitudinal studies can be conducted. Furthermore, exploring the role of external factors like familial support, peer relationships, and societal pressures can provide a holistic understanding of rumination across cultures.

Consider introducing educational reforms that focus on holistic development rather than mere academic achievements. This might alleviate some of the pressures leading to rumination.

In sum, while both Chinese and Czech college students face the challenges of young adulthood, their cultural backgrounds seem to influence how they internally process these experiences. While Czech students exhibited higher levels of rumination, it's vital to understand that rumination, though a risk factor for various psychological issues, can be addressed and managed with appropriate interventions.

#### 6.1.1.3 Mobile Phone Addiction

The digital age has brought with it the challenge of balancing the myriad benefits of technology with its potential drawbacks. Among these, mobile phone addiction is

an increasingly recognized concern, especially among the younger demographic. The present study has offered crucial insights into the differences in mobile phone addiction levels between Chinese and Czech college students. Notably, Chinese college students scored substantially higher in terms of mobile phone addiction compared to their Czech counterparts. This pronounced difference could be rooted in multiple factors, both cultural and systemic.

China has seen rapid technological advancements in the last few decades. The integration of mobile platforms such as WeChat not only in social life but also in financial transactions and other everyday tasks could contribute to increased mobile phone usage (Montag et al., 2018). Furthermore, the societal expectations and pressures prevalent in China, especially around academic achievement, could potentially lead students to use mobile phones as an escape mechanism (Li et al., 2018). Conversely, the Czech Republic, with its distinct cultural and social background, might not have such deep-rooted dependencies on mobile platforms, leading to a reduced tendency toward mobile phone addiction.

The educational environments in both countries might also play a role. The highly competitive nature of the Chinese educational system might induce more stress, leading students to lean on digital platforms as a coping mechanism (Q.-Q. Liu et al., 2017). In contrast, the Czech educational system might offer different challenges and stressors, which may not drive students towards excessive mobile phone usage.

The onset of exposure to mobile phones and other digital platforms might vary between the two countries. Early and prolonged exposure to mobile phones can increase the risk of developing addictive behaviors (Samaha & Hawi, 2016).

With the recognition of the high mobile phone addiction levels, especially among



Chinese students, there's a pressing need for targeted intervention programs. Cognitive-behavioral therapy (CBT) has shown promise in addressing internet and mobile phone addiction, helping individuals recognize and modify their problematic behaviors (Shaw & Black, 2008).

Both countries could benefit from promoting 'digital detox' initiatives within educational institutions. Encouraging students to allocate specific times of the day where they disconnect can help in mitigating the risks of addiction (Kaplan et al., 2017).

Equipping parents and educators with the knowledge and tools to recognize early signs of mobile phone addiction can facilitate timely interventions. This could be particularly beneficial in high-risk populations such as the Chinese student cohort (Kaplan & Haenlein, 2019).

A deeper exploration into the specific reasons behind the high addiction scores among Chinese students is warranted. Understanding the underlying causes can aid in devising more effective intervention strategies.

Collaboration between countries can also provide a platform for sharing strategies and best practices to tackle mobile phone addiction (Lei et al., 2020).

In conclusion, while technology offers numerous benefits, its overuse, leading to addiction, is a concern that warrants attention. The clear disparities in mobile phone addiction levels between Chinese and Czech college students highlight the need for culturally sensitive, targeted interventions. As we continue to integrate technology into every facet of our lives, creating a balanced relationship with it becomes paramount.

#### 6.1.1.4 Mental Health Literacy

The presented study set out to compare mental health literacy scores between Czech and Chinese university students and has yielded some intriguing results.

It is evident that Czech students scored considerably higher than Chinese students across all dimensions of mental health literacy. This finding is supported not only by significant t-values but also by large effect sizes, especially in the attitude dimension. Historically, mental health literacy has been influenced by a combination of factors, including cultural beliefs, education, and societal attitudes (Jorm et al., 1997). Therefore, these results could be a reflection of the broader socio-cultural influences and educational policies that shape understanding and attitudes toward mental health in both countries.

For instance, the attitude dimension, which displayed the most significant difference between the two groups, can be influenced by cultural factors. Chinese society has traditionally held stigmatizing views on mental health, viewing it as a familial or personal issue rather than a health concern (Chen & Mak, 2008). This might explain the lower attitude scores among Chinese students. In contrast, European countries like the Czech Republic have been making strides in mental health awareness campaigns, which might have contributed to better attitudes among Czech students (Hansson et al., 2013).

Similarly, the knowledge dimension showed that Czech students outperformed Chinese students. Prior research has highlighted the role of education in improving mental health literacy (Kutcher et al., 2013). It is possible that the Czech educational system places more emphasis on mental health education, leading to better-informed students.

The results in the information dimension also echoed the trends found in other dimensions. One potential explanation could be the availability and accessibility of mental health resources. European nations tend to have better mental health infrastructure and resources, allowing students to access relevant information more efficiently (Thornicroft et al., 2017).

While the boxplot visualization provided a clear overview of the discrepancies between the two groups, it is also crucial to consider the outliers present, especially for the Chinese students. These outliers might suggest that a subset of Chinese students possesses mental health literacy comparable to their Czech counterparts. This could be attributed to personal experiences, exposure to global perspectives, or specialized education.

To bridge the mental health literacy gap, it is crucial to incorporate comprehensive mental health education in Chinese universities. This should focus not only on knowledge but also on shifting attitudes and beliefs about mental health (Wei et al., 2015). In addition, encouraging students from both countries to engage in exchange programs can help in sharing best practices and understanding diverse perspectives on mental health (Smith & Khawaja, 2014). Furthermore, digital platforms can be utilized to disseminate accurate information about mental health. Given the widespread use of technology among university students, platforms like mobile apps and online courses can be instrumental (Hao et al., 2023).

Both countries should invest in mental health resources, especially China, where there is a significant gap. This includes not only informational resources but also counseling services and helplines (Roh et al., 2016). Future studies should explore the underlying factors contributing to these differences. Collaborative research between European and Chinese universities can provide deeper insights and pave the way for

effective interventions (Velten et al., 2018).

## 6.1.2 Differences between countries in respect to gender

### 6.1.2.1 Perceived Stress

The present study aimed to examine the perceived stress scores among Chinese and Czech college students and to discern the potential differences influenced by gender. The findings indicated notable differences in perceived stress between Czech and Chinese college students. Specifically, Czech students reported significantly higher perceived stress levels than their Chinese counterparts, regardless of gender. Furthermore, while gender differences in perceived stress scores were found to be significant in the Czech sample, no such differences were observed among the Chinese students.

These findings resonate with previous research suggesting that cultural context might influence the ways students experience and report stress. For instance, Hofstede's (1980) study on cultural dimensions noted that countries might differ in terms of individualism-collectivism, power distance, uncertainty avoidance, and masculinity-femininity (Hofstede, 1984). In the context of the current study, the higher perceived stress scores among Czech students might be influenced by factors such as the educational system, socio-economic conditions, or societal expectations. Moreover, European countries and Asian countries often have distinct approaches to education, potentially influencing student stress levels (Chou et al., 1998).

The observed gender difference in perceived stress scores among Czech students is aligned with past research which indicates that men and women might experience and respond to stress differently due to a combination of biological, psychological, and social factors (Matud, 2004). It's intriguing to note, however, that while Czech

female students reported slightly lower stress levels than their male counterparts, this pattern was not mirrored among Chinese students. This absence of gender difference in the Chinese sample could be attributed to cultural norms and values. For example, China's traditional Confucian values emphasize balance, harmony, and collective well-being, potentially moderating the gender differences in perceived stress(Lun, 2012).

The effect sizes, as indicated by Cohen's *d*, while being statistically significant, were relatively small for gender differences within each country. This suggests that while gender might play a role in perceived stress among Czech students, the magnitude of its influence is minimal. In contrast, the moderate effect size observed in the differences between Czech and Chinese students underscores the importance of cultural context in understanding stress among college students.

It is crucial to consider potential factors that might contribute to the observed differences. For instance, the role of social support, coping mechanisms, and academic expectations might be influential. Previous research has suggested that social support can act as a buffer against stress, particularly in collectivist cultures like China(Kim et al., 2008). Moreover, coping strategies, whether problem-focused or emotion-focused, could differ across cultures, further influencing perceived stress levels(Folkman & Lazarus, 1988).

#### 6.1.2.2 Rumination

Our findings reveal that while there were no significant gender differences in rumination scores within each country, there were noticeable disparities in rumination scores between the two countries, with Czech students displaying higher levels of rumination than their Chinese counterparts.

The absence of significant gender differences in rumination scores within both cohorts aligns with some earlier studies. For instance, Johnson and Whisman (2013) found minimal gender differences in rumination in a community sample (Johnson & Whisman, 2013). However, other research has indicated that women tend to ruminate more than men, especially in Western populations. The lack of gendered differences in our study might be attributed to the unique pressures faced by college students, where both genders might be equally vulnerable to rumination due to academic pressures, social challenges, and transition-related stresses (Nolen-Hoeksema & Jackson, 2001).

The cross-country differences in rumination are more pronounced, and these findings add to the growing body of research that highlights the influence of cultural factors on psychological processes. Previous studies have suggested that rumination may be influenced by cultural norms related to emotional expression, problem-solving, and coping mechanisms (Kashdan & Roberts, 2007). For instance, Czech Republic, as a European nation, may have different cultural norms, expectations, and values that influence the cognitive processes underlying rumination. Culturally bound factors such as individualism, self-expression, and emotional openness might be more pronounced in European cultures and can contribute to higher rumination scores (Hofstede, 1984).

On the other hand, Chinese culture, influenced by Confucian teachings, tends to value emotional restraint and promotes problem-solving through reflection and seeking harmony (Tan, 2017). This cultural context may lead to reduced overt rumination, as internalizing and suppressing negative emotions can be seen as a way to maintain social harmony and face. Additionally, the Eastern perspective on interconnectedness and the focus on holistic well-being might deter prolonged rumination, which is perceived as counterproductive to personal and social

equilibrium(Markus & Kitayama, 2014).

The observed effect sizes indicate a moderate difference in rumination scores between the two countries for both genders. These cross-national disparities underscore the importance of considering cultural contexts when investigating psychological constructs. Not only do they shape the individual's lived experiences, but they also offer a set of coping mechanisms, values, and beliefs that can either mitigate or exacerbate ruminative tendencies(Mor & Winqvist, 2002).

In conclusion, our findings emphasize the significant influence of cultural context on rumination among college students. While the pressures of college life can lead to increased rumination regardless of gender, cultural norms, values, and coping mechanisms play a pivotal role in determining the degree of rumination experienced. Future research could delve deeper into the specific cultural factors that contribute to these differences and explore interventions that cater to these unique cultural contexts.

#### 6.1.2.3 Mobile Phone Addiction

### **Discussion**

The present research sought to explore and compare mobile phone addiction scores between Chinese and Czech college students while factoring in potential gender-specific differences. The study unveils an intriguing pattern: although no significant gender-related variations in mobile phone addiction were detected within each country's cohort, stark differences emerged between Chinese and Czech students at large, irrespective of their gender.

The absence of significant gender differences within both the Czech and Chinese student populations resonates with certain past research. For example, a study by Chóliz (2010) identified no gender discrepancies in mobile phone addiction among

adolescents(Chóliz, 2010). This might suggest that the underlying factors driving mobile phone addiction - be it social networking, gaming, or information seeking - might be uniformly appealing or pertinent to both genders in college settings.

However, the more salient findings pertain to the pronounced differences in mobile phone addiction scores between the two countries. Chinese students, both male and female, displayed considerably higher addiction scores compared to their Czech peers. This disparity might be rooted in a combination of socio-cultural, technological, and educational factors.

China's technological landscape, especially regarding mobile applications and services, has witnessed rapid evolution. Platforms such as WeChat, which seamlessly integrate social networking, financial transactions, and multiple utilities, could make mobile phones more ingrained in daily life(Montag et al., 2018). This extensive and multifaceted use can potentially foster higher levels of dependency and, consequently, higher addiction scores.

Cultural differences might also play a pivotal role. The collectivist nature of Chinese society emphasizes interpersonal relationships and group affiliations(Hofstede, 1984). Mobile phones, being primary tools for social connection and interaction, might therefore be used more intensely, fostering increased dependency. In contrast, Czech culture, leaning more towards individualism, might not place the same level of emphasis on constant connectivity, resulting in comparatively lower addiction scores(Schwartz & Ros, 1995).

Educational settings and demands can also contribute. For instance, in China, where academic pressures and competition are intense, students might be more inclined to seek escape or relief through their mobile phones(Wu et al., 2013). In



contrast, if the Czech educational environment is perceived as less pressurized or if there are different recreational avenues available, Czech students might not resort to their phones as heavily (Vrabcová, 2015).

The observed large effect sizes in our findings emphasize the depth of this divergence between Chinese and Czech college students. Such stark differences, beyond mere statistical significance, highlight a pressing need to recognize and potentially address the rising tide of mobile phone addiction, especially in regions or demographics where it is particularly rampant.

In closing, while this research sheds light on the variances in mobile phone addiction scores between Chinese and Czech college students, it also underlines the importance of understanding the broader socio-cultural and environmental factors that influence such patterns. Future research should delve deeper into these intricacies, ideally leading to more tailored interventions that resonate with specific cultural or demographic needs.

#### 6.1.2.4 Mental Health Literacy

The findings of this research elucidate notable disparities in mental health literacy scores both between the two countries under examination—China and Czech—and between genders within those countries. Mental health literacy, defined as the knowledge and beliefs about mental disorders, has become increasingly pertinent in recent times as awareness about mental health issues grows globally (Jorm et al., 1997).

The research points out a distinct difference in mental health literacy scores between genders, especially among Chinese students. While the difference was statistically insignificant in Czech students, Chinese female students demonstrated

significantly higher mental health literacy than their male counterparts. Previous research has indicated that gender plays a role in mental health literacy, with females often displaying a better understanding of mental health issues (Swami, 2012). This can be attributed to societal norms that encourage emotional openness and mental health discourse among females as compared to males.

In both countries, females scored slightly higher than males in knowledge of mental health issues, with the difference being significant in China. This resonates with the findings of Furnham & Hamid (2014) who suggested that females generally have a better understanding and knowledge about mental disorders than males (Furnham & Hamid, 2014). The gender difference in knowledge can be tied back to traditional societal roles where females are often caregivers and thus might be more exposed to and knowledgeable about mental health.

The scores between genders were closely aligned in both countries, suggesting that both males and females are equally adept at sourcing information about mental health. This is heartening, as it indicates that both genders have equal access to resources, a critical component of mental health literacy (O'Connor et al., 2014).

While Czech students demonstrated negligible gender-based difference in attitude scores, Chinese female students showcased a significantly more positive attitude toward mental health than their male peers. This is consistent with prior research which has demonstrated that females typically exhibit more empathetic attitudes towards mental illness (Cotton et al., 2006). The positive attitude among females can also be attributed to their generally better understanding and knowledge of mental health issues, as outlined earlier.

The visual representation further accentuates the disparities between the genders

and the countries. One overarching observation from the data is the consistently higher scores of Czech college students in comparison to their Chinese peers in all categories. This could be indicative of the varied emphasis on mental health education, societal attitudes, and accessibility to mental health resources in the two nations (Kutcher et al., 2016). The difference might also point towards cultural factors that prioritize or de-prioritize mental health discussions and awareness.

In conclusion, the disparities highlighted in the research emphasize the need for targeted mental health literacy initiatives that are both country-specific and gender-sensitive. Considering the pivotal role mental health plays in overall well-being, equipping the youth—especially college students—with the right knowledge and attitude is imperative. Gender differences, especially those highlighted among Chinese students, underscore the importance of tailoring mental health programs that cater to the unique needs and challenges faced by different genders.

### 6.1.3 Inter-countries differences in respect to combined education of parents

#### 6.1.3.1 Perceived Stress

The presented research underscores a significant connection between parental educational attainment and the perceived stress levels of college students in both the Czech Republic and China. Notably, for most educational categories, Chinese students seem to report higher median stress levels than their Czech counterparts, apart from students in the 'Both university' category. This observation corroborates past studies which have highlighted the intense academic pressures and expectations faced by students in certain Asian countries, including China (Li et al., 2017). Such heightened expectations often stem from cultural values that place a premium on academic success as a path to social mobility (Chen & Stevenson, 1995).

The more consistent stress perceptions among Chinese students, especially in the 'Both primary' and 'Both vocational' categories, indicate a certain homogeneity in the experience of academic pressures. A narrower distribution spread in perceived stress for these categories' hints at a collective societal influence in China that may contribute to this uniformity. In contrast, the wider spread among Czech students suggests a more varied range of experiences and perhaps a more individualistic approach to academic pressures and challenges. Previous research has illuminated that collectivist cultures, such as China, often prioritize group consensus and harmony, leading to more uniform responses to societal pressures (Singelis et al., 1995). Conversely, individualistic cultures like the Czech Republic may have diverse individual responses to similar stressors.

The presence of outliers in both countries is intriguing. These outliers signify that there are students who perceive their stress levels to be significantly different from their peers, regardless of their parents' educational backgrounds. This could be attributed to a myriad of factors beyond parental education, such as personal resilience, coping mechanisms, and individual life experiences (Lazarus & Folkman, 1984). Moreover, it indicates that while parental education can be a predictor of perceived stress, it is by no means the sole determinant.

The exception noted in the 'Both university' category is especially noteworthy. In this category, Czech students reported higher median stress levels compared to their Chinese counterparts. This may hint at a possible "reversal" in stress perception dynamics when parents have the highest educational attainment. One potential explanation could be the increased expectations and pressures on Czech students whose parents have both attained university degrees, perhaps because of a societal expectation that these students would naturally excel, having come from highly

educated families. In contrast, Chinese students with parents of similar educational backgrounds might experience reduced pressures, given the already established academic legacy within their families. This idea aligns with previous research which suggests that first-generation college students often face different challenges and pressures compared to their counterparts whose parents have attained higher degrees (Gardner, 2001).

In conclusion, while the educational attainment of parents does influence the perceived stress levels of college students in both countries, the nature and magnitude of this influence vary. Cultural values, societal expectations, and individual resilience all interplay in shaping these perceptions. As educators and policymakers seek to understand and address student well-being, it is imperative to consider these multifaceted influences, and not view parental education as a singular determinant of student stress.

#### 6.1.3.2 Rumination

The results delineated in Table 4.10 and Figure 4.4 provide an intriguing look into the association between parents' combined educational backgrounds and the rumination scores of college students in the Czech Republic and China. The construct of rumination, characterized by repetitive, intrusive thoughts about negative experiences (S Nolen-Hoeksema & J Morrow, 1991), has been linked with various negative psychological outcomes, including depression (Treyner et al., 2003). Understanding the potential predictors of rumination, such as socio-cultural or parental educational backgrounds, is crucial for elucidating its etiology and prevalence in different populations.

For students whose parents had both attained only primary education, the

rumination scores were somewhat comparable between the Czech and Chinese samples. This suggests that when parents have lower educational attainments, the socio-cultural differences between these two countries might not play a significant role in the rumination levels of their offspring. This is in line with previous research that has indicated that low socio-economic backgrounds might lead to similar levels of psychological distress across different cultures (Lorant et al., 2003).

However, the disparity becomes more pronounced for college students where at least one parent completed high school. Czech students reported higher rumination scores than their Chinese counterparts. One potential explanation could be the differing value systems and educational pressures in these two nations. Historically, education has been highly valued in Chinese culture, with a strong emphasis on academic achievement and success (Hesketh & Ding, 2005). In such contexts, having at least one parent with a high school education might alleviate some academic pressures for Chinese students, reducing their propensity to ruminate.

Interestingly, no significant differences were observed for students with both parents completing high school and other categories until both parents had a university education. This might indicate that once a certain educational threshold is reached, the impact on rumination scores becomes less pronounced, up until both parents attain university degrees.

The most striking difference arises for students whose parents both have university degrees. Czech students reported significantly higher rumination scores compared to their Chinese peers. A potential interpretation of this finding hinges on the cultural nuances of academic pressures. While both countries value education, the experience of growing up in households with highly educated parents might be distinct. In the Czech context, highly educated parents might place substantial

expectations on their children, which can increase stress and rumination (Hanáková et al., 2015). In contrast, in China, having parents with university degrees might provide a protective buffer, as it often implies better socio-economic standing and access to resources (Li & Lavelly, 2003).

Figure 4.4 further underscores these findings, emphasizing the variability in the Chinese sample compared to the Czech sample. The presence of outliers in the Chinese data, especially in the "both primary" and "both vocational" categories, might indicate unique individual experiences or pressures that deviate from the norm.

In conclusion, the present findings underscore the importance of considering both socio-cultural and familial educational backgrounds when examining rumination in college students. The stark contrasts between Czech and Chinese students, especially among those with highly educated parents, highlight the intricate interplay of cultural, societal, and familial factors. These findings beckon further research to delve deeper into the specific cultural and familial mechanisms driving these differences.

#### 6.1.2.3 Mobile Phone Addiction

The study sought to illuminate the disparities in mobile phone addiction scores among college students in China and the Czech Republic concerning the educational level of their parents. Unmistakably, across almost all categories of parental education, Chinese students consistently manifested elevated mobile phone addiction scores compared to Czech students. This divergence prompts several intriguing discussions rooted in cultural, socioeconomic, and educational factors that might account for such differences.

One plausible explanation for the higher mobile phone addiction scores among Chinese students is the cultural variance between China and the Czech Republic. Eastern cultures, such as China, emphasize collectivism, where interpersonal relationships and social networks are paramount (Hofstede, 1984). The surge of smartphones has facilitated instantaneous communication, which might be more appealing to individuals from collectivist cultures, where maintaining close interpersonal connections is highly valued. In contrast, the Czech Republic, aligning more with Western cultures, might prioritize individualism, which does not stress constant connectivity as heavily. As such, students in China might be more inclined to use their mobile phones frequently to stay connected with their extensive social networks, leading to higher addiction scores.

Another perspective to consider is the differing role and accessibility of technology in the two nations. China has rapidly metamorphosed into a technological powerhouse, with companies like Tencent and Alibaba revolutionizing how people communicate, shop, and even bank (Lee, 2017). Such integration of mobile phone usage in daily life can compound the perceived necessity and dependence on these devices. In comparison, although the Czech Republic is technologically advanced, the all-encompassing mobile ecosystem seen in China may not be as prevalent.

The association between parental education and mobile phone addiction scores is particularly captivating. A conceivable inference is that students with higher-educated parents, especially in urban areas of China, might have easier access to smartphones and the internet from a young age (Li et al., 2023). In contrast, in the Czech Republic, the saturation and accessibility of technology might be more uniformly distributed across different educational and socioeconomic strata.

One intriguing observation is the similarity in scores for students whose parents



both had vocational education. Vocational education often entails specific skill sets that might not necessarily align with heavy tech usage (Müller & Wolbers, 2003). It is possible that the emphasis on manual or practical skills in vocational settings could translate to similar mobile phone usage patterns in offspring, regardless of the country.

However, some limitations should be addressed. While the study robustly indicates disparities between the two nations, it doesn't dive deep into individual-level data, which might offer more granular insights. Furthermore, without qualitative data, discerning the exact motivations or reasons for such disparities remains speculative. Future studies could incorporate mixed methods or explore other potential mediating factors like urban vs. rural settings, gender, or specific mobile usage patterns.

In conclusion, the observed differences in mobile phone addiction scores between Chinese and Czech college students, as influenced by their parents' education levels, offer a compelling glimpse into the broader tapestry of cultural, technological, and educational nuances that shape behavioral tendencies. As technology continues to permeate every facet of human life, studies like this underscore the importance of understanding its implications across diverse contexts.

#### 6.1.3.4 Mental Health Literacy

The research offers an insightful analysis of the mental health literacy scores among college students from the Czech Republic and China. There appears to be a correlation between the education levels of students' parents and the students' mental health literacy scores. Such a correlation is noteworthy and should be a matter of discussion among stakeholders, educators, and policymakers.

The consistent trend of Czech students outperforming their Chinese peers in terms of mental health literacy across all parental education backgrounds is a striking

finding. Previous research has highlighted the significance of cultural, educational, and sociological factors in influencing mental health literacy (Jorm et al., 1997). The Czech Republic's and China's contrasting cultural backgrounds and societal values may partially explain these disparities. For instance, European cultures traditionally place a significant emphasis on individualism, which might lead to greater self-awareness and, subsequently, better mental health literacy. On the other hand, many Asian cultures value collectivism, where individuals might suppress personal feelings for the sake of societal or familial harmony (Hofstede, 1984).

Another angle to approach this is the availability and accessibility of mental health resources and education in the respective countries. According to the World Health Organization (2019), countries vary widely in their mental health education and awareness programs (Organization, 2019). While the Czech Republic has been actively integrating mental health into the mainstream education system, China has been catching up in recent years with various initiatives and programs to combat mental health stigmatization.

The fluctuating median scores for knowledge across different parental educational levels, particularly where Chinese students marginally outscore Czech students in some categories, are intriguing. It may suggest that factors other than parental education, such as individual motivation, personal experiences, or societal influences, also play a crucial role in shaping mental health knowledge. It is consistent with the findings of Wang et al. (2012), which indicated that a blend of both formal education and informal societal experiences shape an individual's mental health literacy (Wang et al., 2013).

The difference in scores related to the ability to acquire information presents a mixed pattern. This may be attributed to the rapidly changing digital landscape in

China, offering more avenues for young adults to acquire information. In contrast, Czech students might rely on traditional educational frameworks more heavily (Chan et al., 2011). The importance of understanding how students from different cultural backgrounds access and process information cannot be understated, as this impacts how mental health education should be designed and delivered.

Attitudes toward mental health seem to have a clear correlation with the educational background of parents in both countries. This finding aligns with the works of Corrigan and Watson (2007), who posited that more educated families tend to have more enlightened views on mental health issues, reducing stigma and promoting a more positive attitude towards seeking help (Corrigan & Watson, 2007).

In conclusion, the present research has illuminated the interplay between parental education and students' mental health literacy across two diverse cultures. These findings underscore the importance of adapting mental health education and interventions based on cultural and sociological factors. As the world becomes increasingly globalized, understanding these nuances is pivotal in creating effective mental health programs and policies.

#### 6.1.4 Comparison across time periods

##### 6.1.4.1 Comparison in Chinese sample

The explanation of the research results provided here offers a comprehensive breakdown of the comparative analysis of the Chinese samples from 2022 to 2023. Given the contextual backdrop of the COVID-19 pandemic lockdown in 2022, when college students' activities were restricted in Sichuan, China, it is evident that there were distinct shifts in their psychological and behavioral patterns by 2023 when the lockdown was lifted.

In 2022, during the period of lockdown in Sichuan, China, students experienced a certain lifestyle marked by significant restrictions in their daily activities. Such unprecedented changes could inherently bring about shifts in psychological behaviors and patterns.

Starting with mental health literacy, the slight increase in the mean score from 106.74 in 2022 to 107.89 in 2023 might suggest a gradual enhancement in students' ability to recognize, manage, and prevent psychosocial disorders. However, given that the change was not statistically significant, which is similar with the study of Shiming et al.(2022), it implies that the lockdown's effects might not have had a substantial impact on the participants' mental health literacy(Li et al., 2022).

On the other hand, the mobile phone addiction scores indicate a different story. The significant increase from 2022 to 2023 could be reflective of the heightened dependency on mobile devices during the lockdown. With limited outdoor activities and face-to-face social interactions, students might have resorted to digital platforms for leisure, communication, and academic purposes(Chen & Zhang, 2023; Ma et al., 2022). The persistence of this increased score in 2023 suggests that the patterns of mobile usage developed during the lockdown could have long-term implications.

Similarly, the rise in perceived stress scores from 2022 to 2023, albeit small, is statistically significant. This increment could signify the cumulative stress factors experienced during the lockdown, such as academic pressures, lack of physical activity, and social isolation, which might have had lingering effects even after the lockdown was lifted(Cianfarani & Pampanini, 2023). There is also a possibility of escaping from freedom, students could have attributed their academic difficulties to the epidemic and the lockdown in 2022, but once the lockdown was lifted, they might have realized the true extent of their academic challenges, leading to greater stress,

according to Tang et al. (2023), which indicated that students often found online teaching less effective than traditional classroom teaching. Many felt that they weren't learning as effectively, which could contribute to increased academic stress once in-person classes resumed.

Most prominently, the spike in rumination (RM) scores is alarming. The marked increase from 40.89 in 2022 to 49.24 in 2023 represents the most significant change among all the variables analyzed. This could be an indication of the intensified tendency of students to focus repetitively on the causes and consequences of their distress during and post-lockdown. A large effect size underscores the profound psychological impact the lockdown might have had on students' mental well-being.

The first reason may be delayed psychological reactions. It's not uncommon for individuals to experience delayed psychological reactions to traumatic or stressful events (Garay et al., 2023). While the immediate phase of the lockdown might have instilled feelings of survival and adaptation, the aftermath could have allowed for deeper introspection (Garay et al., 2023). Once the immediate threat was removed, students might have had more time and mental bandwidth to reflect upon the lockdown's impact, leading to increased rumination. It could also be explained by post-lockdown adjustment issues. Transitioning back to a "normal" life after an extended period of lockdown is not always seamless (Lawal et al., 2023). Students might have faced challenges readjusting to social interactions, academic pressures, or changed university environments. This period of transition could lead to increased rumination as they continuously evaluated and contemplated these changes. In addition, the post-lockdown period might have been rife with uncertainties about potential resurgences, academic backlogs, job markets, and more (Biassoni et al., 2023; Bryce et al., 2022). The anxiety stemming from these uncertainties could have fueled

higher rumination levels as students pondered potential future scenarios.

Considering these findings, the research underscores the importance of considering the broader societal and environmental contexts when interpreting psychological data. The effects of significant events, such as the COVID-19 lockdown, can have varying impacts on different aspects of mental health and behavior, as evidenced by the distinct patterns observed in this study's variables.

#### 6.1.4.2 Comparison in Czech sample

The comparative analysis of Czech college students across 2022 and 2023, focusing on variables such as mental health literacy (MHL), mobile phone addiction (MPA), perceived stress (PSS), and rumination (RM), provides an intriguing perspective on the psychological and behavioral patterns of student's post-lockdown.

The slight increase in mental health literacy scores from 2022 to 2023 is heartening. This increment, albeit non-statistically significant, points to a possible trend of students being better informed about mental health issues and their manifestations, a phenomenon observed globally due to the enhanced discourse surrounding mental well-being during the pandemic (Smith et al., 2020). Despite the overall awareness levels being comparably high in both years, it's imperative that universities continue their efforts in mental health education, as it is a key component in early identification and intervention of psychological concerns.

The data indicated a marginal decrease in MPA scores from 2022 to 2023. Past research has shown that during lockdowns, people often resorted to technology as a primary means of communication, entertainment, and information, which could lead to an increase in screen time and potential addictive behaviors (Lanaj, Johnson, & Barnes, 2014). As the Czech universities transitioned out of the lockdown in 2022,

students might have found more offline engagements, reducing their dependence on mobile phones. However, the decrease, being non-statistically significant, implies that the behavior did not change drastically over the year.

The negligible change in PSS scores between 2022 and 2023 suggests a consistent level of stress among the students. The maintenance of stress levels, even post-lockdown, indicates other potential stressors apart from the lockdown itself. Academic pressures, uncertainties about prospects, or adapting to a post-pandemic world might have played a role (Orben et al., 2020). This consistency reinforces the necessity for continued stress management resources and counseling for students.

The decrease in rumination scores from 2022 to 2023, even if non-statistically significant, is worth noting. High rumination can be a byproduct of isolation and limited social interactions, as found during extended lockdowns (Nolen-Hoeksema et al., 2008). As social interactions increased post-lockdown, students might have found more outlets for their thoughts, reducing their tendency to ruminate. This pattern contrasts with the Chinese students' data, where an increase in rumination was observed, underscoring the cultural and contextual differences in coping and psychological responses across countries.

The overall trend observed in the Czech samples between 2022 and 2023 emphasizes the resilience of students in the face of challenges and the adaptive mechanisms they might have employed during and post-lockdown. While no significant changes were noted across the variables, the subtle shifts provide valuable insights. Universities, educators, and policymakers must consider these nuanced patterns when designing interventions and support mechanisms. Furthermore, as the world continues to adapt to the new normal, ongoing research will be paramount to understanding and addressing the long-term psychological implications of such

unprecedented global events.

## 6.2 Correlation analysis and path analysis

### 6.2.1 Correlation analysis

The correlational findings of this study align with existing literature that establishes intricate associations among mental health literacy, mobile phone addiction, perceived stress, rumination, and academic achievement.

The significant negative correlation between perceived stress and academic achievement ( $r = -0.371$ ,  $p < 0.01$ ) is consistent with the body of research indicating that heightened stress levels are detrimental to students' academic performance (Lepp et al., 2015). The stress-performance curve, or Yerkes-Dodson law, posits that while a moderate level of stress can enhance performance, excessive stress impairs cognitive functions and thus academic outcomes (Yerkes & Dodson, 1908).

Similarly, the positive correlation between perceived stress and rumination ( $r = 0.639$ ,  $p < 0.01$ ) aligns with Nolen-Hoeksema's (1991) response styles theory, which postulates that individuals prone to rumination are more likely to dwell on stressors and negative emotions, thereby exacerbating stress (Nolen-Hoeksema, 1991).

The positive relationship between rumination and mobile phone addiction ( $r = 0.189$ ,  $p < 0.01$ ) can be understood through the lens of escapism theory, which suggests that individuals may turn to their mobile phones as a means to escape negative thoughts and feelings, leading to addictive behaviors (Kardefelt-Winther, 2014).

The negative correlation found between mobile phone addiction and academic achievement, especially in academic performance ( $r = -0.235$ ,  $p < 0.01$ ), echoes findings by Samaha and Hawi (2016), who demonstrated that the overuse of



smartphones can impinge on students' ability to concentrate on academic tasks, thus hindering their performance (Samaha & Hawi, 2016).

Mental health literacy's negative correlation with mobile phone addiction ( $r = -0.338$ ,  $p < 0.01$ ) supports the notion that individuals with better mental health knowledge and attitudes are less likely to engage in maladaptive coping mechanisms such as phone addiction (Gulliver et al., 2010). Moreover, the positive correlation between mental health literacy and academic performance ( $r = 0.306$ ,  $p < 0.01$ ) suggests that understanding mental health issues could foster strategies that enhance academic resilience and performance (Kutcher et al., 2016).

In conclusion, these correlations substantiate the study's hypotheses and contribute to the growing empirical evidence regarding the factors influencing academic achievement. The interdependencies noted highlight the importance of addressing mental health literacy and stress management as strategies for reducing maladaptive coping such as rumination and excessive mobile phone use, which in turn may bolster academic performance.

## 6.2.2 Path analysis

### 6.2.2.1 Mediation model with moderating effects in total sample

The figure 5.1 displays a mediation model with moderating effects, indicating how perceived stress, rumination, mobile phone addiction, and mental health literacy interact with each other and what their combined impact on academic achievement is. Based on this model and associated statistics, several conclusions can be drawn that are consistent with existing psychological theories and research.

Firstly, the model shows a significant direct effect of rumination on academic achievement. Rumination, or the tendency to repetitively think about the causes, situational factors, and consequences of one's negative emotional experience, is

known to deplete cognitive resources that could otherwise be allocated to academic tasks (Nolen-Hoeksema et al., 2008). It's noteworthy that this is in alignment with research indicating that rumination can impair working memory (Lyubomirsky et al., 2003), which is crucial for academic success.

The model does not show a direct significant effect of perceived stress or mobile phone addiction on academic achievement, which may seem counterintuitive given the body of research linking stress and excessive technology use with poor academic outcomes (Lepp et al., 2015). This may suggest that these factors alone do not have a direct impact on academic performance but could be influential through interaction with other variables such as rumination and mental health literacy.

Mental health literacy is shown to have a significant interaction effect with rumination on academic achievement. This indicates that students with higher mental health literacy might be better equipped to manage their rumination, possibly through effective coping strategies that mitigate its negative impact on academic performance. This is consistent with research suggesting that mental health literacy can improve mental health outcomes and coping strategies (Jorm, 2012) .

The model also suggests that mental health literacy might moderate the impact of perceived stress on academic achievement, though this interaction is not statistically significant. This could mean that students with higher mental health literacy might be better at managing stress in ways that minimize its potential negative effects on academic work. However, since this result is not statistically significant, it would be premature to draw firm conclusions without further research.

The potential moderating role of mental health literacy between mobile phone addiction and academic achievement, although not significant, suggests a direction for

future research. It could be hypothesized that understanding the impacts of mobile phone use on mental health and learning might help students use technology more effectively, thus reducing its potential negative impact on studies.

Since the model using the total score of the Academic Achievement Scale as the dependent variable was not significant enough, we switched to using the study performance subscale of the Academic Achievement Scale as the dependent variable to do another model analysis. The statistical results from the chain mediation model with moderating effects suggest a complex interplay among perceived stress, rumination, mobile phone addiction, and study performance, with mental health literacy emerging as a significant moderator.

Firstly, the positive relationship between perceived stress and rumination aligns with the Response Styles Theory, which posits that rumination is a maladaptive coping strategy that people often use when dealing with distress, potentially leading to exacerbated symptoms of depression and anxiety (Nolen-Hoeksema, 1991). This is consistent with cognitive theories that link stress to increased negative thought patterns (Garnefski et al., 2001). High levels of perceived stress increase the likelihood of engaging in rumination, which can worsen the stress (J. M. Smith & L. B. Alloy, 2009).

The significant direct effect of perceived stress on mobile phone addiction can be understood in the context of the Compensatory Internet Use Theory, which suggests that individuals may turn to the internet or mobile phones to cope with psychological distress (Kardefelt-Winther, 2014). This pattern is likely to lead to an unhealthy dependence on these devices, termed as mobile phone addiction.

The negative relationship between rumination and study performance is

supported by research indicating that rumination can impair working memory and cognitive resources, reducing academic performance (Lyubomirsky et al., 2003). Similarly, mobile phone addiction's negative impact on study performance is consistent with findings that excessive phone use can lead to decreased academic performance due to distractions and reduced study time (Lepp, Barkley, & Karpinski, 2015).

Mental health literacy, found to be a moderator in these relationships, can provide individuals with better coping mechanisms and strategies to deal with stress, thereby reducing the tendency to ruminate or turn to mobile phone addiction (Jorm, 2012). This is evident from the significant interaction effects in the model, suggesting that higher mental health literacy can buffer the negative impacts of stress.

The conditional effects of perceived stress on study performance based on different levels of mental health literacy highlight the nuanced roles literacy plays. At lower literacy levels, stress appears to increase study performance, potentially a manifestation of the Yerkes-Dodson law, where a certain level of stress can enhance performance (Yerkes & Dodson, 1908). However, as mental health literacy increases, the model suggests that stress may become more deleterious to performance, possibly because individuals with higher literacy are more aware of stress' negative impacts, which can in turn affect their academic performance.

In summary, these results indicate that enhancing mental health literacy could be a valuable target for interventions aimed at reducing the negative effects of stress on both mental well-being and academic outcomes.

#### 6.2.2.2 Mediation model with moderating effects in Chinese sample

The presented results from the chain mediation model with moderating effects

suggest several pathways that contribute to academic achievement in a Chinese sample. The significant positive relationship between perceived stress (PSS) and rumination (RM) aligns with previous research indicating that higher levels of stress can lead to increased rumination, a maladaptive pattern of thinking that is focused on negative aspects of oneself or one's experience (Nolen-Hoeksema, 2000). The positive coefficient ( $\beta = 2.6277$ ) suggests that as perceived stress increases, so does the tendency to engage in rumination.

Mental health literacy (MHL) is also shown to be positively associated with rumination, which is interesting because one might expect that higher mental health literacy could help individuals manage stress and negative thought patterns more effectively. However, the positive relationship ( $\beta = 0.4755$ ) indicates that in this sample, individuals with greater awareness and understanding of mental health issues may be more prone to ruminate, perhaps due to increased recognition and contemplation of their own mental health symptoms (Jorm, 2000).

Contrary to some findings in the literature, the relationship between rumination and mobile phone addiction (MPA) is positive ( $\beta = 0.5482$ ), which could suggest that individuals who ruminate more might turn to their mobile phones as a form of distraction or avoidance, potentially leading to addictive patterns of mobile phone use (Billieux et al., 2015).

Interestingly, mobile phone addiction shows a positive association with academic achievement ( $\beta = 0.0527$ ) in the Chinese samples, which is somewhat counterintuitive and contrary to past research suggesting that addiction to mobile phones is generally associated with negative academic outcomes (Lepp, Barkley, & Karpinski, 2014). This could be due to the nuanced role that mobile phones play in modern education, where they can be both a tool for learning and a source of distraction. Mobile phones

can serve as educational tools in China. Students may use their phones to access educational resources, engage in interactive learning, and communicate with peers and instructors (Thomas & Muñoz, 2016). If students are using their mobile phones primarily for academic purposes, this could lead to a positive correlation with academic achievement. Mobile phones could increase access to educational materials for students who might otherwise lack resources. This is especially relevant for online or blended learning environments, which have become more prevalent (Benson & Ward, 2013). In addition, cultural factors could play a role in how technology is used and regulated. In some cultures, mobile phone use might be more structured and oriented toward productive activities, including education (Selwyn, 2007). Additionally, Chinese students often face high academic expectations, which could influence how they utilize mobile phones for their studies (Li et al., 2014). Finally, another reason is that the way 'mobile phone addiction' is measured may not fully capture problematic use. If the scale used includes items that reflect frequent but not necessarily problematic use, the results might show a positive association with academic outcomes (Oulasvirta et al., 2012).

The interaction terms suggest moderating effects of mental health literacy on the relationships between rumination, mobile phone addiction, and academic achievement. The significant interaction terms for academic achievement,  $RM * MHL$  ( $\beta = 0.007$ ) and  $MPA * MHL$  ( $\beta = -0.006$ ), imply that mental health literacy modifies how rumination and mobile phone addiction relate to academic achievement. It could be that higher mental health literacy buffers the negative impact of rumination on academic achievement and mitigates the potentially positive effect of mobile phone addiction on academic performance. Self-regulation theory posits that individuals with higher mental health literacy may have better self-regulation skills (Vohs &

Baumeister, 2004). This could mean they are more adept at managing their time and attention, which may buffer against the negative effects of rumination and control their mobile phone use more effectively, thus protecting their academic achievement. Moreover, according to Lazarus and Folkman (1984), individuals with greater mental health literacy may have a more extensive repertoire of coping strategies (Lazarus & Folkman, 1984). This knowledge could help students mitigate the stress associated with mobile phone addiction and rumination.

These findings contribute to a complex understanding of how stress, mental health awareness, and technology use intersect to affect academic achievement. Future research should investigate these relationships further, especially the unexpected positive relationship between mobile phone addiction and academic achievement.

When the dependent variable is converted into study performance, this chain mediation model with moderating effects will have slight differences in the Chinese sample.

Perceived stress was also found to have a direct positive effect on study performance, which is contrary to some previous research that often finds stress to have a negative impact on academic achievement (Misra & McKean, 2000). However, the positive direction of this effect could be influenced by cultural factors related to the Chinese educational context, where some degree of stress is often considered normative and may be associated with high levels of motivation and effort (Ang et al., 2007). The positive association between perceived stress and study performance in the Chinese educational context could be an instance of what is sometimes referred to as "eustress," which is a form of stress that can actually enhance motivation and performance. This concept aligns with the Yerkes-Dodson Law, which postulates that

there is an optimal level of arousal (stress) that leads to peak performance; too little arousal can lead to underperformance, just as too much can lead to stress-related performance deficits (Yerkes & Dodson, 1908). The cultural valuation of education in many Asian contexts, particularly in China, is deeply influenced by Confucian principles, which have long been integral to the fabric of East Asian societies. Confucianism is not only a philosophy but also a rigorous system of moral, social, political, and educational teachings that emphasize several key virtues. The Confucian value system, which emphasizes diligence, perseverance, and valuing education, may contribute to a mindset where stress is seen as a necessary and accepted part of academic achievement (Hwang, 1987; Li, 2012). Especially Diligence (勤, qín) and Perseverance (忍, rěn), this ethos promotes a culture where sustained hard work, patience, and fortitude are considered essential for success, and thus, the stress that comes with it is regarded as an integral part of the learning process (Fwu et al., 2018). Moreover, Chinese students often exhibit high achievement motivation, and stress is sometimes the byproduct of high personal and familial expectations for success. This motivation can help maintain performance even in the presence of stress (Yu et al., 1994).

The relationship between rumination and mobile phone addiction (MPA) was significant and positive, indicating that higher levels of rumination are associated with increased mobile phone addiction. This is in line with the notion that individuals may engage in maladaptive coping strategies, such as excessive use of mobile phones, to distract themselves from ruminative thoughts (Elhai et al., 2017).

The significant interaction between rumination and mental health literacy (MHL) in predicting study performance suggests that higher levels of mental health literacy may buffer the negative impact of rumination on academic achievement. Individuals



with greater mental health literacy may possess better coping strategies to manage their ruminative thinking, thus reducing its detrimental effects on study performance (Jorm, 2000). In explaining the moderating effect of mental health literacy (MHL) on the relationship between rumination and academic achievement, the construct of mental health literacy, as defined by Jorm et al. (1997), refers to the knowledge and beliefs about mental disorders which aid their recognition, management, or prevention. Higher mental health literacy equips individuals with the ability to recognize harmful patterns of thought such as rumination—a repetitive and passive focus on symptoms of distress and its potential causes and consequences (Nolen-Hoeksema, 1991). With better mental health literacy, individuals are more likely to engage in proactive coping mechanisms and to seek appropriate help, potentially mitigating the negative impacts of rumination on academic performance (Jorm, Korten, Jacomb, Christensen, Rodgers, & Pollitt, 1997; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). These coping strategies may include cognitive-behavioral techniques that are known to reduce ruminative thought patterns, thereby potentially buffering the adverse effects of rumination on study performance (Watkins & Nolen-Hoeksema, 2014).

#### 6.2.2.3 Mediation model with moderating effects in Czech sample

The findings from the moderated chain mediation effect test in a sample of Czech college students, which identified only a positive correlation between perceived stress and rumination, as well as a significant positive correlation between rumination and mobile phone addiction, reflect nuanced dynamics that are not fully captured by the model. This lack of comprehensive fit might be explained by the transactional theory of stress, which emphasizes that stress is experienced and managed differently by each individual based on their cognitive appraisals and coping resources (Lazarus & Folkman, 1984).

The lack of significance in the paths from perceived stress to mobile phone addiction, and the various interaction terms involving mental health literacy (MHL), rumination (RM), and mobile phone addiction (MPA) to academic achievement, can be influenced by a variety of factors unique to the Czech college student sample. Some students may use the energy from their ruminative thoughts as a motivational tool, which could explain the lack of a significant negative relationship (Seligman, 2006). The Czech academic environment may not reinforce the negative effects of rumination on achievement. For instance, there might be structures in place that support students who are struggling, such as counseling services or study groups (Wang et al., 2012). In addition, If students use their phones for academic purposes, such as organizing study sessions or accessing educational materials, this could negate the expected negative relationship (Kubey et al., 2001). The content and quality of mobile phone use are highly variable; students may engage in behaviors that do not detrimentally impact their academic performance (Rosen et al., 2014).

The students might have more effective coping mechanisms that buffer against the negative effects of stress, such as engaging in outdoor activities or social support systems, thus not resorting to mobile phone use as a coping strategy (Smyth, 2007). There could be cultural attitudes that discourage excessive use of mobile phones among Czech students, which would weaken the relationship between stress and mobile phone addiction (Hofstede, 1984).

Furthermore, the significant positive correlation between rumination and mobile phone addiction can be seen through the lens of problematic internet use models, which suggest that individuals might turn to their devices as a maladaptive coping strategy to deal with negative emotions and thoughts (Caplan, 2002). This relationship is particularly pertinent in the context of academic environments, where the pressure

to succeed can intensify such patterns (Wang et al., 2012).

The absence of significant paths and moderation effects in the model, however, suggests that other factors, potentially specific to the Czech cultural and educational context or individual differences not accounted for in the model, might play critical roles in academic achievement. For instance, cultural values regarding education, social support systems, and other coping strategies may interact in complex ways that the model does not address (Elder Jr, 1994; Hofstede, 2001). Additionally, the singular focus on negative aspects of stress may overlook the potentially motivating role that eustress (positive stress) can play in student achievement (LePine et al., 2004).

Overall, while the model captures certain aspects of the students' experiences, it lacks the complexity needed to account for the full range of factors influencing academic achievement. The findings suggest the need for a more holistic approach, considering a broader array of psychological, behavioral, and cultural factors.

In a sample of Czech college students, after analysis, a complete chain mediation model with moderating effects was formed. Taking perceived stress as the independent variable, rumination and mobile phone addiction as the mediating variable, and study performance as the dependent variable, mental health literacy plays a moderating role in the relationship between mobile phone addiction and study performance. Based on the provided model and the significance of the paths, it can be interpreted that in this sample of Czech college students, stress affects study performance primarily through a chain mediation process involving rumination and mobile phone addiction. In other words, perceived stress leads to increased rumination, which in turn leads to higher levels of mobile phone addiction, and this sequence of events negatively impacts study performance.

This model can be explained by the self-control theory and the theory of planned behavior. Among them, Self-Control Theory highlight the role of self-control in managing one's behavior and emotions(Mischel, 2012). High levels of stress and rumination can deplete self-regulatory resources, making it more difficult for students to resist the temptation of mobile phone use, leading to addiction and, consequently, poorer study performance. Then the theory of planned behavior suggest that individuals' behaviors are driven by their intentions, which are influenced by their attitudes, norms, and perceived control over the behavior(Bosnjak et al., 2020). Mental health literacy could contribute to more positive attitudes and perceived control over mental health challenges, which could moderate the impact of mobile phone addiction on study performance.

By applying these theories, we can understand that the chain mediation model illustrates a sequence where stress leads to cognitive patterns (rumination) that increase the likelihood of engaging in maladaptive behaviors (mobile phone addiction) that negatively impact outcomes (study performance), with individual knowledge and attitudes towards mental health (mental health literacy) potentially mitigating some of these effects.

#### 6.2.2.4 Differences between Chinese and Czech samples

The observed differences between the Chinese and Czech college student samples regarding the mediation of rumination and the moderation effects of mental health literacy can be attributed to several underlying reasons, often rooted in cultural, educational, and societal frameworks.

In the Chinese sample, perceived stress (PSS) has a significant positive effect on rumination, and rumination, in turn, significantly predicts mobile phone addiction (MPA). However, in the Czech sample, while perceived stress still significantly

predicts rumination, stress does not significantly predict mobile phone addiction. This could suggest cultural differences in response to stress—where the Chinese students might be more prone to ruminate, leading to mobile phone addiction, Czech students might employ different coping mechanisms.

Cultural context significantly shapes individuals' coping strategies. Chinese students might be experiencing higher academic pressures due to societal expectations, leading to more rumination as a stress response(Zhao et al., 2015), particularly in the realm of academic stress and its management, is substantiated by various research findings across different educational systems. The comparison between Chinese and Czech students' responses to academic stress highlights the influence of cultural expectations, educational practices, and societal norms on stress coping mechanisms. Chinese students face an education system that places enormous emphasis on performance, particularly on high stakes testing such as the Gaokao(Wang et al., 2022). The Gaokao is not merely an examination but a pivotal life event that can determine the trajectory of a student's future, influencing their social status and job prospects(Yang et al., 2023). This immense pressure to perform can instill a chronic pattern of worry and rumination, which persists even after the examination has concluded(Hamnett et al., 2019). The stress performances related to academic performance are often internalized as a continuous state of concern over grades and test scores, reflecting a cultural norm that equates academic success with personal worth and future success(Cai et al., 2019). Furthermore, the educational environment in China is often characterized by rote memorization, a lack of educational diversity, and a scarcity of creative or leisurely pursuits within the curriculum, which can limit students' ability to develop diverse coping strategies(Lin & Ross, 1998). Consequently, the persistent rumination on academic performance may reflect the limited avenues

available to students to process and manage their stress in constructive ways.

In contrast, the Czech educational system and societal attitudes may offer a wider range of stress management strategies and less intense academic pressures (Bařtová et al., 2004). The Czech approach to education, while still valuing academic success, may not link it as tightly to future success and personal worth (Covington & Roberts, 2012). This difference can result in a less stressful educational experience and a cultural context that permits a variety of recreational and creative pursuits alongside academic work (Fitzgibbon & Murphy, 2023). Such a balance can contribute to healthier coping strategies, such as engaging in hobbies, sports, or social activities that help mitigate the negative effects of stress. The differing responses to academic stress between Chinese and Czech students, therefore, can be seen as a product of the respective cultures' values, educational philosophies, and societal expectations. These cultural and systemic differences inform the development of coping strategies among students and can have long-term impacts on their mental health and academic achievement.

For the Chinese sample, rumination predicts mobile phone addiction, and mobile phone addiction significantly predicts academic achievement. However, in the Czech sample, there is no significant relationship between mobile phone addiction and academic achievement. This difference could be indicative of how mobile phone use is perceived or regulated in academic settings or differing self-regulation skills across the two cultures. In the Chinese context, there is evidence suggesting that the intense academic pressures lead students to seek escape through their mobile phones, potentially leading to addictive behaviors. The use of mobile phones as a coping mechanism for stress and rumination is observed, particularly when students are faced with the overwhelming demands of the educational system and parental expectations.

This reliance on mobile devices for stress relief could consequently impact their academic performance negatively due to the distraction and reduced study time (Bai et al., 2020). Additionally, the high value placed on academic success in Chinese society may lead to a stronger negative correlation between mobile phone addiction and academic achievement, as any activity that detracts from study is seen as directly harmful to prospects. Furthermore, the prevalence of online academic resources and the integration of mobile technology into learning may contribute to the blurred lines between beneficial and detrimental mobile phone use, leading to more problematic usage patterns among Chinese students (Li et al., 2015). In contrast, the Czech educational system may not exhibit the same degree of emphasis on rote learning and high-stakes exams, allowing for a more balanced lifestyle with leisure activities considered an essential part of a student's life. The perception and regulation of mobile phone use within academic settings could be more relaxed, and students may be better equipped with self-regulation skills that allow them to manage their mobile phone use without it significantly impeding their academic performance (Vondráčková & Gabrhelík, 2016). Furthermore, Czech students might be benefiting from a broader educational approach that promotes a variety of interests and skills beyond the academic realm. The impact of mobile phone use on academic achievement may not be as pronounced if the educational culture understands and accommodates the varied dimensions of a student's life, thus not directly associating mobile phone use with academic decline (Tomczyk & Kopecký, 2016).

In the Chinese sample, mental health literacy moderates the relationship between rumination and academic achievement. This suggests that in China, an understanding of mental health issues might help mitigate the negative impact of rumination on academic performance. However, the Czech sample shows no significant moderating

effect of mental health literacy on any of the relationships. This could point towards different levels of awareness or different societal attitudes towards mental health literacy and its importance in academic settings. In China, the increasing recognition of mental health issues among young people, especially concerning the high levels of stress related to academic performance, has led to a greater emphasis on mental health literacy. The Chinese government and educational institutions have been working on integrating mental health education into the curriculum to better prepare students to recognize and cope with stress and anxiety, which are prevalent due to the highly competitive education system (Lam, 2014). As a result, students with higher mental health literacy are potentially better equipped to manage their rumination and mitigate its negative impacts on academic performance (Lim et al., 2015). Moreover, the collectivist culture in China might contribute to a stronger influence of MHL on academic outcomes because there is a tendency to seek harmony and collective well-being (Wu et al., 2017). When students are literate in mental health, they might be more willing to apply coping strategies that align with their academic goals, adhering to the societal emphasis on educational success (Wu et al., 2020). On the other hand, the Czech Republic may not place the same level of importance on academic competition, and the educational environment may be less stressful, resulting in less of a need for mental health literacy to play a moderating role. Czech society might have a different approach to mental health, possibly with a greater emphasis on general well-being rather than the direct connection to academic achievement. Thus, while mental health literacy is undoubtedly important, its immediate impact on academic outcomes might not be as pronounced (Van Beveren et al., 2020). Furthermore, the Czech educational system's approach to mental health may be more preventative in nature, focusing on creating a supportive environment that prevents stress and rumination from escalating, rather than relying on mental health literacy to



intervene in the relationship between these factors and academic performance (Pyšná et al., 2022).

The interaction effects between  $RM*MHL$ , and  $MPA*MHL$  are significant in the Chinese sample but non-significant in the Czech sample. This could suggest that in the Chinese context, mental health literacy plays a more integral role in how stress and its consequences affect academic achievement. The Chinese educational system is known for its rigorous and competitive nature, where academic success is highly valued. The pressure to perform well is immense, particularly because of the Gaokao, which is seen as a determinant of future success. Consequently, students with higher MHL might have more resources to understand and manage their stress, reducing the negative impact of rumination on academic outcomes (Bai et al., 2020). In China, there is a cultural shift towards acknowledging the importance of mental health, especially among the younger population. This shift means that those with higher MHL may engage in healthier coping strategies, like seeking social support or professional help, rather than turning to maladaptive behaviors like excessive mobile phone use, which has been linked to poor academic performance (Sun et al., 2022). Chinese educational institutions have been increasingly incorporating mental health education and resources for students, reflecting a policy-level recognition of the impact of mental health on academic success. Students who take advantage of these resources might be better equipped to handle the stressors of academic life, thereby reducing the risk of negative outcomes like mobile phone addiction (Shi et al., 2020). In contrast, the non-significant interaction effects in the Czech sample may indicate that while mental health literacy is important, it does not interact with rumination or mobile phone use in the same way or may face less academic pressure compared to their Chinese counterparts, thereby reducing the overall impact of stress on academic

achievement(Kleszczewska et al., 2021). Second, the Czech culture may promote a variety of stress-relief strategies that are not as dependent on mental health literacy for their efficacy(Burnard et al., 2008). Moreover, Czech educational institutions may emphasize preventative measures to address stress, which might make the role of MHL less pivotal in the interaction with stress-related behaviors like rumination and mobile phone use(Hoskovcová & Sikorska Iwona, 2014).

In the chain mediation model analysis with moderating effects using study performance as the dependent variable, there are some differences. There is a strong, direct path from rumination to mobile phone addiction (0.5482), and a negative direct path from mobile phone addiction to study performance (-0.1164) in Chinese sample. This suggests a chain reaction where stress leads to rumination, which then translates into mobile phone addiction, detrimentally affecting study performance. In Czech sample, the path from rumination to mobile phone addiction is still positive (0.4762) but weaker than in the Chinese sample. Moreover, mobile phone addiction has a smaller but significant negative direct effect on study performance (-0.0834), indicating that while rumination may lead to mobile phone addiction, it does not have the same level of negative impact on the students' academic achievement. In China, educational pressures are intense, and students often face high levels of stress due to a competitive environment driven by the Gaokao exam and societal expectations (Liu & Helwig, 2022). This stress can lead to increased levels of rumination, where students repetitively think about their academic pressures and concerns (Kleinman, 2004). Mobile phones can serve as a distraction from these pressures, offering a temporary escape that can become habitual, thus leading to addiction (Du et al., 2023). The strong link between rumination and mobile phone addiction might be a result of the immediate gratification and relief provided by mobile phones (Dou et al., 2020). The

negative impact of mobile phone addiction on study performance is consistent with findings that excessive mobile phone use can lead to decreased academic productivity and poorer academic outcomes (Bai et al., 2020).

The educational culture in the Czech Republic does not center around a single high-stakes exam to the extent seen in China. As a result, Czech students may experience less academic-related rumination (Lopes et al., 2023). The relationship between rumination and mobile phone addiction, while present, is weaker. This may indicate that Czech students have more varied coping mechanisms beyond mobile phone use, which can include social support systems, leisure activities, and possibly more balanced lifestyles (Kopecký et al., 2021). The non-significant impact of mobile phone addiction on study performance could be due to a more integrated approach to technology within their academic environments, where mobile phone use is perhaps regulated in a way that minimizes interference with academic work (Simonova et al., 2021).

The coefficient for perceived stress to rumination is notably higher in the Chinese sample (2.6277) than in the Czech sample (1.6542). This could reflect the higher academic and societal pressures faced by Chinese students, as previously discussed, where performance and competition are highly emphasized. The notable difference in the coefficients for perceived stress to rumination between the Chinese sample and the Czech sample can be attributed to several factors that are deeply rooted in cultural, educational, and societal contexts. Firstly, the Chinese educational system is known for its highly competitive nature, especially due to the Gaokao examination, which is a national college entrance exam that has significant implications for a student's future career and social status (Zhao, 2016). The pressure to perform well on this single exam can lead to high levels of perceived stress among

Chinese students(Lin et al., 2020). This stress, in turn, may increase the tendency to engage in rumination, as students may constantly reflect on their academic performance and prospects(Li et al., 2019). Secondly, the concept of 'face' or social standing is deeply ingrained in Chinese culture. Academic achievement is not only a personal matter but also a reflection of family honor(WEI et al., 2023). Failure or even mediocre performance can be seen as a loss of face(Hwang, 2006), which adds to the stress experienced by students. This cultural emphasis on honor and social perception can exacerbate the levels of rumination as students may dwell more on potential failures and their implications(Chen et al., 2023). Thirdly, the societal expectations in China place a strong emphasis on educational attainment as a pathway to success(Li et al., 2021). This societal pressure can create an environment where students are more likely to experience chronic stress and engage in rumination over their academic and personal lives. Moreover, Chinese students may have fewer coping strategies available to them due to limited school-based mental health resources and a cultural stigma attached to seeking psychological help (Zhou et al., 2019). This can result in more rumination as a default stress response when compared to Czech students who might have more access to a variety of coping mechanisms. Lastly, Cross-cultural studies have shown that Eastern cultures may interpret and react to stress differently than Western cultures. Where Western individuals might be more inclined to take action to change a stressful situation, those from Eastern cultures might be more likely to reflect on it, which can manifest as rumination (Hofstede, 2016). These factors illustrate why the pathway from perceived stress to rumination is stronger for Chinese students, highlighting the interplay between individual stress perception and broader cultural and societal influences.

The interaction effect of mental health literacy on the relationship between

rumination and study performance in Chinese sample is significant (0.0009), and the interaction effect of mental health literacy on the relationship between perceived stress and study performance is also significant (-0.0016), suggesting that MHL can buffer the negative effects of mobile phone addiction on study performance. The coefficient here is smaller (0.0005) path to study performance, indicating that MHL does not significantly moderate the impact of mobile phone addiction on academic achievement in the Czech context. The evidence for the differences in the interaction effect of mental health literacy (MHL) on the relationships involving rumination, perceived stress, and study performance between Chinese and Czech samples can be gathered from understanding the cultural, educational, and mental health system contexts of both countries. Firstly, the Chinese education system is known for its high-pressure exams and competition (Liu & Lu, 2012). The significance of MHL suggests that Chinese students who have a better understanding of mental health can use that knowledge to manage stress and rumination more effectively, leading to less negative impact on study performance. Secondly, there has been an increasing emphasis on mental health education in China, potentially equipping students with better tools to deal with academic pressures (Zhang et al., 2019). Moreover, In China, there may still be a stigma associated with mental health issues (Yin et al., 2020), which means that higher MHL could play a crucial role in overcoming this barrier and applying effective coping strategies. In this research, due to the average total score of MHL of Czech sample is much higher than Chinese sample, which means Czech students already possess a good understanding of mental health issues and know how to manage them effectively. This could lead to a situation where the variance in MHL is lower among Czech students, and as such, its potential to act as a moderator is less observable. The first possibility is Reduced Variability, High average scores with low variability in MHL would mean that statistical models might not detect significant

moderation effects simply because there's not enough variation in the moderator to influence the dependent variable(Charlesworth, 1998). The second one is Ceiling Effect, when MHL is already high across the board, there's less room for it to vary enough to show a significant moderating effect on the relationship between stress, phone addiction, and academic performance(Austin & Brunner, 2003). If most of them score high on MHL, its impact becomes part of the norm and is less distinctive.

### 6.3 Recommendations based on this study

The present study embarked on an exploration of the interrelations between perceived stress, rumination, mobile phone addiction, mental health literacy, and their collective impact on academic achievement among college students in Sichuan, China, and the Czech Republic. Through a robust methodological approach utilizing well-established psychometric instruments, the research unearthed several key findings.

Firstly, perceived stress was significantly correlated with increased levels of rumination and mobile phone addiction, indicating that higher stress levels might predispose students to engage more in ruminative thought patterns and addictive phone use behaviors. Notably, rumination served as a mediating variable, exacerbating the effects of stress on mobile phone addiction, which, in turn, was inversely related to academic achievement. This suggests a cascading effect where stress leads to rumination, which potentially escalates into mobile phone addiction, ultimately impairing academic performance.

Secondly, mental health literacy emerged as a crucial moderating variable within this model. Higher levels of mental health literacy appeared to attenuate the adverse effects of perceived stress on rumination and mobile phone addiction. Students with better mental health awareness and understanding were found to be more resilient to stress-related challenges and less likely to succumb to maladaptive coping

mechanisms such as rumination and excessive phone use.

Furthermore, comparative analyses revealed cross-cultural variations with implications for both stress perception and management strategies. Chinese students exhibited different patterns of coping compared to their Czech counterparts, highlighting the influence of cultural contexts on stress and its consequences.

Overall, the study provided valuable insights into the dynamics of stress and its far-reaching implications on student well-being and educational outcomes. By integrating the role of mental health literacy, the findings underscore the potential of educational interventions to mitigate the detrimental effects of stress on students' academic and psychological domains.

Educational programs designed to increase mental health literacy should be comprehensive and integrated into the school curriculum. These programs should include:

(1) **Basic Education on Mental Health:** Courses or workshops that provide information on common mental health issues, their symptoms, and the dangers of untreated mental health problems.

(2) **Stress and Rumination Specifics:** Focused sessions on understanding stress and rumination, their triggers, and their physiological and psychological impacts.

(3) **Coping Strategies:** Teaching a variety of coping mechanisms, such as mindfulness, cognitive restructuring, and relaxation techniques, tailored to manage stress and prevent rumination.

(4) **Help-Seeking Behavior:** Encouraging students to seek help by normalizing mental health discussions and providing information on where and how to get

professional support.

(5) Critical Thinking About Mental Health: Developing critical thinking skills to analyze and question societal and cultural attitudes towards mental health and academic pressure.

(6) Peer Education: Training peer educators who can support their fellow students, recognize signs of distress, and provide information on available resources.

In terms of cultural differences, cultural awareness campaigns play a crucial role in transforming societal attitudes towards academic pressure and mental health. By launching comprehensive campaigns, stakeholders can educate the community about the detrimental impacts of excessive academic pressure on students' psychological well-being. These campaigns should aim to convey that while education is important, it should not come at the cost of a student's mental health.

The campaigns could utilize various media platforms, including social media, television, radio, and print, to disseminate information. They should feature stories and testimonials from students who have experienced high levels of stress and how it has affected their lives. By bringing personal stories to the forefront, the campaigns can humanize the issue, making it more relatable and prompting a more empathetic response from the audience.

Moreover, these campaigns should highlight the concept of mental health literacy, which encompasses the ability to recognize, manage, and prevent mental health issues. Workshops, seminars, and interactive sessions can be organized in schools and universities to educate students, teachers, and parents about the signs of mental health struggles and the importance of seeking help.

A significant aspect of these campaigns would be to destigmatize mental health



issues. This can be achieved by normalizing conversations around mental health and challenging existing prejudices and misconceptions. Influential figures, such as celebrities, educators, and professionals, can be enlisted to speak openly about their experiences with stress and mental health care, thereby setting a precedent that seeking psychological help is a sign of strength, not weakness.

Additionally, the campaigns should provide information on where and how students can seek psychological help, including hotlines, counseling centers, and online resources. They should emphasize that mental health is just as important as physical health and that there are resources available for those who need them.

Partnerships with mental health organizations can also be beneficial in ensuring that the campaigns are informed by the latest research and best practices in mental health care. These organizations can provide expertise and credibility, further encouraging public trust and engagement.

Ultimately, the goal of cultural awareness campaigns is to create an environment where academic pressures are balanced with the understanding that mental health is paramount. By changing the narrative around academic success and mental health, these campaigns can pave the way for a more supportive and healthier educational environment.

Policy advocacy in the context of educational stress involves engaging with educational authorities, policymakers, and stakeholders to reform the aspects of the educational system that contribute to high levels of stress among students. The current emphasis on test scores and university admission rates as the primary indicators of success can create an environment where students feel immense pressure to perform, often at the expense of their mental and emotional well-being.

Advocates can push for a more holistic approach to education that values individual student growth, learning processes, and well-rounded development alongside traditional academic achievement. This approach would recognize the diverse talents and interests of students, rather than focusing narrowly on test scores.

To initiate policy change, it is essential to gather and present evidence on the impact of academic stress on students' mental health and academic outcomes. This could involve collecting data on the correlation between high-stress educational environments and the prevalence of mental health issues like anxiety, depression, and the tendency to ruminate on negative thoughts.

Armed with this data, advocates can work to influence the development of policies that:

- Reduce the weight of single examinations in determining a student's future opportunities.
- Encourage multiple forms of assessment that consider different learning styles and intelligences.
- Promote a more comprehensive evaluation system that includes project-based assessments, collaborative work, and creative outputs.
- Implement limits on homework and after-school tutoring to ensure students have time for rest and extracurricular activities.
- Encourage universities and employers to consider a broader range of criteria for admission and hiring, such as community service, leadership experience, and personal projects.

Policy advocacy should also involve dialogue with educational institutions to encourage them to adopt these changes and to support them in the transition. This could include providing resources for teacher training on the new assessment methods

and on recognizing and addressing student stress.

Furthermore, advocates should strive to involve the wider community in these discussions, including parents, students, and mental health professionals. By creating a coalition of stakeholders who are invested in the well-being of students, policy advocacy efforts can gain momentum and public support.

In addition to advocating for policy changes at the institutional and governmental levels, there should be efforts to shift societal attitudes towards education and success. This could involve public awareness campaigns that challenge the stigma around non-traditional paths to success and that highlight the value of mental health and personal well-being.

Ultimately, policy advocacy for reducing academic stress is about creating an educational culture that values and nurtures the whole student. It's about recognizing that a one-size-fits-all approach to education is not only ineffective but can also be harmful. By advocating for policies that reflect these values, we can help to create an environment where students are able to pursue success without sacrificing their mental health.

#### 6.4 Limitation

Although it has developed a chain mediation model with moderating effects and contributed to cross-cultural research and the expansion of the research field of mental health literacy, this study also has certain limitations.

The first limitation of this research is that the study uses a cross-sectional design, it can only capture a snapshot in time and cannot establish causality. Longitudinal studies would be needed to observe how relationships between variables change over

time.

Secondly, the representativeness of the sample, depending on the selection criteria and the method of gathering participants, the samples may not be representative of all Chinese or Czech college students. The samples may suffer from selection bias if they are not adequately randomized or if they are taken from a particular type of institution (such as more prestigious universities).

Lastly, another limitation of this study pertains to the magnitude of the observed effects. While the relationships between variables such as rumination, mobile phone addiction, mental health literacy, and study performance are statistically significant, the effect sizes associated with these relationships are relatively modest. This is particularly evident in the context of the moderating role of mental health literacy. Despite its statistical significance, the effect size of mental health literacy as a moderator is not robust, suggesting that while it does play a role in influencing the relationship between stress-related behaviors and academic outcomes, the practical significance of this moderation is less pronounced.

This modest effect size indicates that there are likely other unmeasured variables or factors at play that could contribute to or mitigate these relationships. Additionally, the small effect sizes may limit the applicability of these findings in practical settings, as the observed changes in study performance are not substantial. This aspect suggests a need for caution when generalizing the findings to broader contexts and implies that future research should investigate additional variables that might have stronger predictive power or interact with mental health literacy to influence academic outcomes more significantly.

Furthermore, it raises questions about the potential for interventions aimed at

improving mental health literacy to effect meaningful changes in academic performance. Such interventions may need to be part of a more comprehensive approach that addresses a broader range of factors impacting student well-being and achievement.

### 6.5 Future Research Prospects

The current study opens several avenues for future research. Given the modest effect sizes observed, particularly concerning the moderating role of mental health literacy, further investigation is warranted to understand the complex dynamics between stress, coping mechanisms, and academic outcomes. Future studies could:

(1) Explore Additional Moderators and Mediators: Investigate other potential moderating factors such as personal resilience, social support, or coping styles that might have a stronger impact on the relationships explored in this study.

(2) Longitudinal Designs: Implement longitudinal research designs to track changes over time and provide a deeper understanding of the causal relationships among perceived stress, rumination, mobile phone addiction, and academic performance.

(3) Cross-Cultural Comparisons: Expand cross-cultural comparisons to include additional cultural contexts and educational systems, which may help to further elucidate how cultural factors influence stress and coping mechanisms.

(4) Intervention Studies: Design and test the effectiveness of interventions aimed at increasing mental health literacy and reducing rumination and mobile phone addiction to improve academic performance. This could also help to clarify the practical implications of the current study's findings.

(5) Quantitative and Qualitative Data: Employ a mixed-methods approach that includes both quantitative data and qualitative insights from students to provide a more nuanced understanding of how students perceive and manage stress.

(6) Broader Psychological Constructs: Incorporate broader psychological constructs such as motivation, self-efficacy, and life satisfaction to see how these factors might interact with mental health literacy and impact academic outcomes.

(7) Technological Integration in Education: As mobile phone addiction emerges as a significant factor; research could also delve into how technology is integrated into students' learning experiences and how it affects their study habits and overall well-being.

By addressing these prospects, future research could contribute to a more comprehensive understanding of the multifaceted influences on academic performance and well-being among college students. This would not only advance academic theory but also inform practical strategies in educational and mental health interventions.

## 7 Conclusion

(1) In the overall sample, Czech college students ( $M=31.15$ ,  $SD=6.99$ ) had significantly higher levels of perceived stress than Chinese college students ( $M=29.33$ ,  $SD=4.87$ ).

(2) In the overall sample, Czech college students ( $M=50.35$ ,  $SD=11.4$ ) had significantly higher rumination levels than Chinese college students ( $M=45.03$ ,  $SD=13.6$ ).

(3) In the overall sample, Chinese college students ( $M=35.27$ ,  $SD=8.19$ ) have significantly higher levels of mobile phone addiction than Czech college students ( $M=24.59$ ,  $SD=9.01$ ).

(4) In the overall sample, Czech college students ( $M=124.18$ ,  $SD=11.41$ ) have

significantly higher levels of mental health literacy than Chinese college students (M=107.31, SD=11.20).

(5) There are no significant gender differences in perceived stress among Czech (male: M=31.18, SD=6.3; female: M=31.15, SD=7.1) and Chinese college students (male: M=29.36, SD=4.3; female: M=29.32, SD=5.2).

(6) There are no significant gender differences in rumination among Czech (male: M=50.35, SD=14.1; female: M=50.20, SD=14.3) and Chinese college students (male: M=45.5, SD=14.6; female: M=46.64, SD=12.7).

(7) There are no significant gender differences in mobile phone addiction among Czech (male: M=25.18, SD=9.2; female: M=24.49, SD=9.0) and Chinese college students (male: M=35.28, SD=8.9; female: M=35.27, SD=7.5).

(8) Among a sample of Czech college students (male: M=2125.4, SD=12.2; female: M=123.96, SD=11.2), there is no significant gender difference in mental health literacy levels, while among a sample of Chinese college students, female's mental health literacy is significantly higher than that of male (male: M=105.07, SD=11.0; female: M=109.17, SD=11.0).

(9) Among the sample of Czech college students, the individual's mental health literacy level increases with the improvement of parents' academic qualifications; while among the sample of Chinese college students, the level of mental health literacy has little relationship with the parents' academic qualifications.

(10) Among Chinese college student samples, the 2023 sample group has significantly higher levels of perceived stress, rumination, and mobile phone addiction than the 2022 sample group, while there is no significant difference in mental health levels between the two groups.

(11) Among Czech college student samples, there are no statistically significant differences between the 2023 sample group and the 2022 group sample in terms of perceived stress, rumination, mobile phone addiction, and mental health literacy levels.

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## Appendix

Dear Students ,

We are researchers from the Faculty of Education and would like to learn more about our students' cell phone usage habits, their knowledge of mental health, and their academic status, in the hope of exploring effective ways to promote healthy living among college students.

This questionnaire is anonymous and is not an examination, so it will not affect you adversely, and your true answers are very important to our research. All the contents of this survey are kept confidential, thank you very much for taking part in this survey!

Gender :    Male    Female

Age :

Grade :

Freshman

Sophomore

Junior

Senior

First year postgraduate student

Second year postgraduate student

3rd year postgraduate student

Did you live at home or in a dormitory when you were in college?:    Home  
dormitory

Your father's education level :

Junior high school and below

Senior High school or secondary school

Junior college

Bachelor's degree or above

Your mother's education level :

Junior high school and below

Senior High school or secondary school

Junior college

Bachelor's degree or above

### **Mental Health Knowledge**

The purpose of these questions is to gain an understanding of your knowledge of various aspects to do with mental health. When responding, we are interested in your degree of knowledge. Therefore when choosing your response, consider that:

Very unlikely = I am certain that it is NOT likely

Unlikely = I think it is unlikely but am not certain

Likely = I think it is likely but am not certain

Very Likely = I am certain that it IS very likely

1

If someone became extremely nervous or anxious in one or more situations with other people (e.g., a party) or performance situations (e.g., presenting at a meeting) in which they were afraid of being evaluated by others and that they would act in a way that was humiliating or feel embarrassed, then to what extent do you think it is likely they have Social Phobia

Very unlikely

Unlikely

Likely

Very Likely

2



If someone experienced excessive worry about a number of events or activities where this level of concern was not warranted, had difficulty controlling this worry and had physical symptoms such as having tense muscles and feeling fatigued then to what extent do you think it is likely they have Generalised Anxiety Disorder

Very unlikely                  Unlikely                  Likely                  Very Likely  
3

If someone experienced a low mood for two or more weeks, had a loss of pleasure or interest in their normal activities and experienced changes in their appetite and sleep then to what extent do you think it is likely they have Major Depressive Disorder

Very unlikely                  Unlikely                  Likely                  Very Likely  
4

To what extent do you think it is likely that Personality Disorders are a category of mental illness

Very unlikely                  Unlikely                  Likely                  Very Likely  
5

To what extent do you think it is likely that Dysthymia is a disorder

Very unlikely                  Unlikely                  Likely                  Very Likely  
6

To what extent do you think it is likely that the diagnosis of Agoraphobia includes anxiety about situations where escape may be difficult or embarrassing

Very unlikely                  Unlikely                  Likely                  Very Likely  
7

To what extent do you think it is likely that the diagnosis of Bipolar Disorder includes experiencing periods of elevated (i.e., high) and periods of depressed (i.e., low) mood

Very unlikely                  Unlikely                  Likely                  Very Likely  
8

To what extent do you think it is likely that the diagnosis of Drug Dependence includes physical and psychological tolerance of the drug (i.e., require more of the drug to get the same effect)

Very unlikely                  Unlikely                  Likely                  Very Likely  
9

To what extent do you think it is likely that in general in Czech Republic, women are MORE likely to experience a mental illness of any kind compared to men

Very unlikely                  Unlikely                  Likely                  Very Likely  
10

To what extent do you think it is likely that in general, in Czech Republic, men are MORE likely to experience an anxiety disorder compared to women

Very unlikely                  Unlikely                  Likely                  Very Likely  
When choosing your response, consider that:

Very Unhelpful = I am certain that it is NOT helpful

Unhelpful = I think it is unhelpful but am not certain

Helpful = I think it is helpful but am not certain

Very Helpful = I am certain that it IS very helpful

11

To what extent do you think it would be helpful for someone to improve their quality of sleep if they were having difficulties managing their emotions (e.g., becoming very anxious or depressed)

Very unhelpful          Unhelpful                  Helpful                  Very helpful

12

To what extent do you think it would be helpful for someone to avoid all activities or situations that made them feel anxious if they were having difficulties managing their emotions

Very unhelpful          Unhelpful                  Helpful                  Very Unhelpful

When choosing your response, consider that:

Very unlikely = I am certain that it is NOT likely

Unlikely = I think it is unlikely but am not certain

Likely = I think it is likely but am not certain

Very Likely = I am certain that it IS very likely

13

To what extent do you think it is likely that Cognitive Behaviour Therapy (CBT) is a therapy based on challenging negative thoughts and increasing helpful behaviours

Very unlikely          Unlikely                  Likely                  Very Likely

14

Mental health professionals are bound by confidentiality; however there are certain conditions under which this does not apply.

To what extent do you think it is likely that the following is a condition that would allow a mental health professional to **break confidentiality**:

*If you are at immediate risk of harm to yourself or others*

Very unlikely          Unlikely                  Likely                  Very Likely

15

Mental health professionals are bound by confidentiality; however there are certain conditions under which this does not apply.

To what extent do you think it is likely that the following is a condition that would allow a mental health professional to **break confidentiality**:

*if your problem is not life-threatening and they want to assist others to better support you*

Very unlikely          Unlikely                  Likely                  Very Likely

Please indicate to what extent you agree with the following statements:

	Strongly Disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
16. I am confident that I know where to seek information about mental illness					
17. I am confident using the computer or telephone to seek information about mental illness					
18. I am confident attending face to face appointments to seek information about mental illness (e.g., seeing the GP)					
19. I am confident I have access to resources (e.g., GP, internet, friends) that I can use to seek information about mental illness					

Please indicate to what extent you agree with the following statements:

	Strongly Disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
20. People with a mental illness could snap out if it if they wanted					
21. A mental illness is a sign of personal weakness					
22. A mental illness is not a real medical illness					
23. People with a mental illness are dangerous					
24. It is best to avoid people with a mental illness so that you don't develop this problem					
25. If I had a mental illness I would not tell anyone					
26. Seeing a mental health professional means you are not strong enough to manage your own difficulties					
27. If I had a mental illness, I would not seek help from a mental health professional					
28. I believe treatment for a mental illness, provided by a mental health professional, would not be effective					

Please indicate to what extent you agree with the following statements:

	Definitely unwilling	Probably unwilling	Neither unwilling or willing	Probably willing	Definitely willing
29. How willing would you be to move next door to someone with a mental illness?					
30. How willing would you be to spend an evening socialising with someone with a mental illness?					
31. How willing would you be to make friends with someone with a mental illness?					

	Definitely unwilling	Probably unwilling	Neither unwilling or willing	Probably willing	Definitely willing
32. How willing would you be to have someone with a mental illness start working closely with you on a job?					
33. How willing would you be to have someone with a mental illness marry into your family?					
34. How willing would you be to employ someone if you knew they had a mental illness?					

## Cell phone usage habits

Please indicate to what extent you agree with the following statements:

	Strongly disagree	Disagree	Weakly disagree	Weakly agree	Agree	Strongly agree
1. Missing planned work due to smartphone use						
2. Having a hard time concentrating in class, while doing assignments, or while working due to smartphone use						
3. Feeling pain in the wrists or at the back of the neck while using a smartphone						
4. Won't be able to stand not having a smartphone						
5. Feeling impatient and fretful when I am not holding my smartphone						
6. Having my smartphone in my mind even when I am not using it						
7. I will never give up using my smartphone even when my daily life is already greatly affected by it.						
8. Constantly checking my smartphone so as not to miss conversations between other people on Twitter or Facebook						
9. Using my smartphone longer than I had intended						
10. The people around me tell me that I use my smartphone too much.						

## Perceived Stress

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate by circling how often you felt or thought a certain way.

	Never	Almost Never	Someti mes	Fairly Often	Very Often
1. In the last month, how often have you been upset because of something that happened unexpectedly?					
2. In the last month, how often have you felt that you were unable to control the important things in your life?					
3. In the last month, how often have you felt nervous and “stressed”?					
4. In the last month, how often have you felt confident about your ability to handle your personal problems?					
5. In the last month, how often have you felt that things were going your way?					
6. In the last month, how often have you found that you could not cope with all the things that you had to do?					
7. In the last month, how often have you been able to control irritations in your life?					
8. In the last month, how often have you felt that you were on top of things?					
9. In the last month, how often have you been angered because of things that were outside of your control?					
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?					

## Ruminant Thinking

The questions in this scale ask you about your feelings and thoughts during the last two weeks.

	Never	Rarely	Sometimes	Always
1) Think about how alone you feel				
2) Think "I won't be able to do my job if I don't snap out of this"				
3) Think about your feelings of fatigue and achiness.				
4) Think about how hard it is to concentrate.				
5) Think "What am I doing to deserve this?"				
6) Think about how passive and unmotivated you feel.				
7) Analyze recent events to try to understand why you are depressed.				
8) Think about how you don't seem to feel anything anymore.				
9) Think "Why can't I get going?"				
10) Think "Why do I always react this way?"				
11) Go away by yourself and think about why you feel this way				
12) Write down what you are thinking and analyze it.				
13) Think about a recent situation, wishing it had gone better				
14) Think "I won't be able to concentrate if I keep feeling this way."				
15) Think "Why do I have problems other people don't have?"				
16) Think "Why can't I handle things better?"				
17) Think about how sad you feel.				
18) Think about all your shortcomings, failings, faults, mistakes.				
19) Think about how you don't feel up to doing anything.				



20) Analyze your personality to try to understand why you are depressed.				
21) Go someplace alone to think about your feelings				
22) Think about how angry you are with yourself				

### Academic Achievement

Below you will find questions about your university achievement. Answer each question by selecting the appropriate response.

1. What is your average (most common) exam mark during university study?	A	B	C	D	E	F
2. What is your average (most common) exam mark in the last semester?	A	B	C	D	E	F
3. What is your best exam mark in the last semester?	A	B	C	D	E	F
4. What is your worst exam mark in the last semester?	A	B	C	D	E	F

	Not at all					Without problem
5. How well can you organize your time for study? Planning class attendance (lectures, seminars, etc.), self-study, other study-related activities, leisure activities and hobbies, part-time job, recreation, etc.	1	2	3	4	5	6
6. How well can you plan time to prepare for exams? For example, you do not manage to prepare for exams, you are not always prepared well, you study at the last minute, or on the contrary you are ready for the exam and you are learning continuously, or in advance, etc.	1	2	3	4	5	6
7. How well do you handle study requirements and demands? Preparation of seminar papers, theses, activity in seminars and exercises, need of independence in studying, self-management during study, fulfilment of formal requirements for essays and theses, etc.	1	2	3	4	5	6
8. How well do you fit among classmates? Establishing relationships with classmates, communication and cooperation with them, spending time together, feeling well with them, etc.	1	2	3	4	5	6
9. How well did/do you adapt to university style of life? Less directive way of teaching by teachers, greater responsibility and emphasis on self-study and selfplanning, more free nature of college life, communication with teachers, less dependent on the family	1	2	3	4	5	6

## Acknowledgments

I am profoundly grateful for the support and guidance offered by several distinguished individuals throughout the duration of my doctoral studies at Palacky University.

Firstly, I extend my heartfelt thanks to Professor Plevova, my supervisor, whose invaluable insights and direction were instrumental in defining the scope and trajectory of my research. Her expertise and thoughtful guidance have deeply influenced my academic journey.

I am especially indebted to Professor Vachova, my supervisor-consultant, for her substantial contributions to my research endeavors. Her assistance in providing the research questionnaire and in the collection of crucial data has been pivotal for the success of my thesis.

I would also like to express my appreciation to Professor Kvintova for affording me numerous opportunities to engage in academic work. Her mentorship has significantly enhanced my skills and has been a cornerstone of my academic development.

Special thanks go to Madam Zdrahalova, the dedicated administrator for international students, whose support and guidance have been invaluable. Likewise, I am thankful to Madam Dostalova for her assistance in providing essential information and materials, which greatly facilitated the completion of my studies.

Finally, I would also like to thank the teachers at the Faculty of Education of Palacky University, who served as my beacon in the ocean of study.

My journey at Palacky University has been enriched and enabled by the collective support of these remarkable professionals, to whom I owe a great debt of gratitude.