



Stressful Life Events and Depression as Predictors of Cognitive Flexibility among International Students of Nottingham Trent University in United Kingdom

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ABSTRACT

International students often face stressful and depressive challenges that often affect their psychological well-being and cognitive functioning. This study investigates whether perceived impact of stressful life events (SLEs) and depression predicts cognitive flexibility (CF) among international students, in Nottingham Trent University in the UK. Standardised instruments such as the Perceived Stress Scale (PSS) for measuring SLEs, the Beck Depression Inventory-II (BDI-II) for assessing depressive symptoms, and the Cognitive Flexibility Inventory (CFI) for evaluating cognitive flexibility, are used for data collection and measuring. The sample comprised 42 participants with a mean age of 26.08 years ($SD = 0.86$), where 71.4% were female and 28.6% were male. Participants reported a mean depression score of 40.68 ($SD = 8.10$), an average of 29.71 stressful life events ($SD = 6.98$), and a mean Cognitive Flexibility Index (CFI) score of 88.94 ($SD = 22.19$). Correlation analyses revealed significant positive relationships between depression and both stressful life events and between stressful life events and CFI. Multiple regression analysis showed that stressful life events significantly predicted cognitive flexibility, while depression had a marginally significant effect. The interaction of stressful life events and depression on cognitive flexibility was also marginally significant. The study concludes that SLEs significantly impact CF among international students, however, depression and interaction (SLEs * Depress) only marginally predict CFI. Despite these findings, the study acknowledges several limitations, including the issue of potential multicollinearity and incomplete responses, suggesting the need for future research with larger, more diverse samples and longitudinal designs to explore the long-term effects and causal pathways.

Keywords: Forensic mental health, depression, cognitive flexibility, international students, United Kingdom, beck depression inventory

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1 INTRODUCTION

According to Statista, there were over 630000 international students studying in the UK during the 2021/2022 academic year, comprising around 22% of the total student population and ranking second in the hosting of international student globally (Dyvik, 2023). An international student (IS), as defined by Shapiro *et al.* (2023) and the United States Citizenship and Immigration Services (Hillman, 2023; USCIS, 2015), as an individual who moves to a host country for tertiary education and is enrolled at an institution of higher education in that country, excluding U.S. citizens, immigrants, and refugees. These students come from different cultural backgrounds, with significant numbers from countries such as China, India, the United States, and various EU nations (Dyvik, 2023). Their different cultures bring in diverse perspectives birthing a multicultural environment that enrich the social fabrics of the campuses and the communities they stay.

Not only do International Students (IS) enrich the ecosystem with their cultures but also contribute economically to the UK economy. According to the Higher Education Policy Institute, international students through their tuition fees, accommodation, and other living expenses boost UK economy by £41.9 billion. This substantial financial input supports not only universities but also local economies translating to £58 million contribution to each of the 650 parliamentary constituencies and to approximately £560 per citizen (Hillman, 2023).

Additionally, the tuition fees from international students help subsidise local student tuition and research and development activities, consequently furthering the position of the UK as a global leader in higher education and innovation (Tsiligiris & Ilieva, 2021).

Despite the economic, social and cultural contributions of IS to the UK, IS often face unique challenges that can impact their mental health and overall well-being. Studies have shown that transition to a new country, particularly those on the extreme opposite of cultural dimensions, are often financially and psychologically challenging (Olatunji, *et al.*, 2023; Shen, 2023). For international students the challenges may involves navigating different cultural norms, financial and academic expectations, and social environments (Bethel, *et al.*, 2020; Wu, *et al.*, 2015). These adjustments can be particularly stressful and, in some cases, lead to mental health issues such as anxiety and depression (Razgulin, *et al.*, 2023).

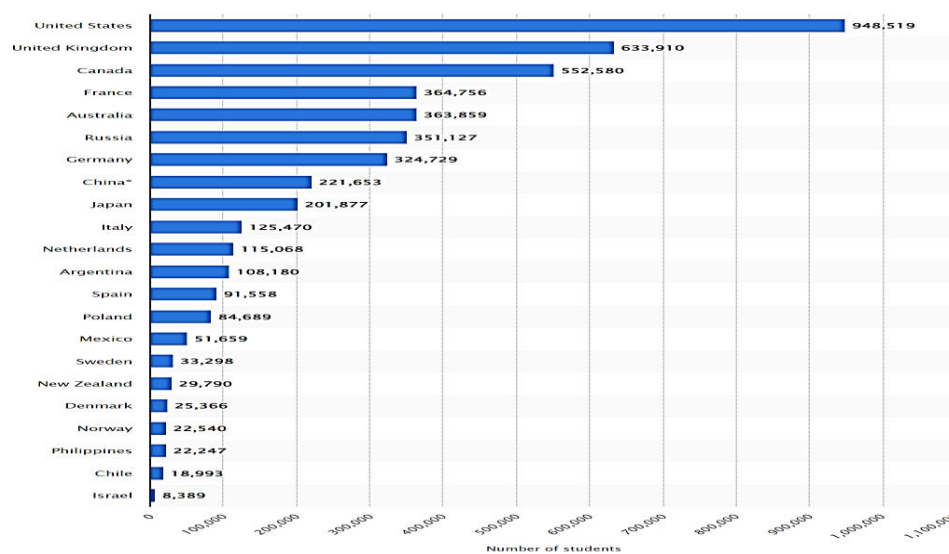


Figure 1.1: Top host destination of international students worldwide in 2022

Source: Dyvik (2023).

To guide the study, the following questions are raised:

- i. How do stressful life events impact cognitive flexibility in international students?
- ii. What is the relationship between depression severity and cognitive flexibility among international student?
- iii. Do stressful life events and depression interact to influence cognitive flexibility among international students?

Also, the following assumptions were tested:

- i. Stressful life events have a significant impact on cognitive flexibility among international students in the UK.
- ii. There is significant relationship between depression severity and cognitive flexibility in international students in the UK.
- iii. Stressful life events and depression interact to influence cognitive flexibility in international student in the UK.

2 LITERATURE REVIEW

2.1 Conceptual clarification

According to Grant *et al.* (2003) and Holmes and Rahe (1967) stressful life events (SLE) are significant, external disruptions that objectively demand adjustment to daily routines, regardless of individual perception. SLE are occurrences that disrupt an individual's usual activities and can precipitate psychological distress. While SLE can be regular (e.g., job demands, adverse childhood experiences etc.), they are not everyday occurrences; but are disruptive experiences like death, job loss, or crime (Brugha and Cragg, 1990; Sarason et al., 1978) which may portend dire consequences on those affected. In the case of international students, such events might also include relocation to a new country, a need for adjustment into a new academic system, financial pressures, and being away from family and familiar support networks (Razgulin, et al., 2023; Ward & Kennedy, 1993). These stressors can be compounded further by experiences of discrimination or cultural isolation, which are unfortunately not uncommon.

2.1.1 Concerns and Importance for International Students' Mental Health in the UK

Annually, thousands of international students move into the UK to further their education, and are met with differing challenges including cultural adjustment needs, language barriers, social isolation and even financial needs, which all contribute to heightened level of stress (Bethel, et al., 2020; Dyvik, 2023; Wu, et al., 2015). Although, Zhang (2016) report that international students benefits from study abroad experience through self-development and personal capital, allowing them become more attentive and tolerant to cultural diversities and other differences, but studies have shown they face a number of challenges. Gao (2021) conducted a systematic review on the challenges face by Doctoral international students. Findings show that language barrier, stringent academic expectations, social disconnectedness, homesickness, discrimination, and culture shock negatively affected international students' sociocultural adaptation. Amid the adjustment and identity challenges, several students conveyed emotional reactions to their transnational learning experiences, such as loneliness, anxiety, isolation, and frustration (Li, 2016; Russell-Pinson & Harris, 2017). Studies have shown that these stressors can adversely impact their academic performance and may further lead to depression (Cogan, et al., 2023; Dodd, et al., 2021; Olatunji, et al., 2023; Ward & Kennedy, 1993). Aside the moral imperative for ensuring the well-being of international students, the globalisations of higher education and its corresponding competition with other host nations, alongside its cultural, social, and economic contributions, necessitate that academic institutions and other stakeholders in the UK show concerns for their mental well-being (Dodd, et al., 2021; Sá, 2018).

2.1.2 Stressful Life Events

Stressful life events encompass experiences or occurrences that trigger alterations in an individual's life which often result in psychological and/or physiological upheavals. These disturbances, also known as stressors, demand varying degrees of coping mechanisms and adaptation efforts (Compas, 1987; Johnson, 1982). The events/stressors can encompass a wide range of both positive and negative experiences, such as personal losses, changes in employment, health crises, relationship upheavals, or even positive life changes like marriage or the birth of a child. Also, it may be cultural and financial adaptation needs, as mostly the case of international students, whose both demographic and psychographic background may be different from that of the host country. These stressors potentially disrupt their functioning state, prompting psychological and physiological responses that can vary in intensity and duration.

Among the many catalysts of depression, stressful life events stand out as significant precursors with profound psychological and physiological impacts. Physiologically, McEwen and Karatsoreos, (2019) report that stress has been found to trigger the “fight or flight” response, triggering increase cortisol and adrenaline hormone levels. The studies have also shown that chronic exposure to these hormones contributes to hypertension, cardiovascular disease, and weakened immune function. Furthermore, research has consistently demonstrated a robust link between these stressors and an elevated risk of different spectrum of psychological illness from mild anxiety and sadness to severe depression and post-traumatic stress disorder (PTSD). For instance, a cross-sectional study by Huang et al. (2022) targeting Chinese college students revealed a pronounced positive correlation between the frequency and severity of stressful life events and the incidence of depression.

2.2 Empirical Review

2.2.1 Stressful Life Events and its Relationship with Depression

A number of studies have shown that exposure to stressful life events is a significant risk factor for developing mental health issues, especially depression (Bjørndal, 2023; Hasanah & Novembriani, 2023; Huang, et al., 2022). According to World Health Organization (2023), over 280 million (3.8%) people are affected by depressive disorder, and is one of the leading causes of disability worldwide (Bhatt, et al., 2023). In the case of University students, studies have report significantly higher rates of mental health problems than the general population (Ibrahim, et al., 2013). However, a study by Jones et al. (2019) that compared international and local students in the University of Bedfordshire, UK, found that, although low self-esteem, lower life satisfaction and poorer general mental health are more pronounced in home student, all students have considerable mental health challenges, including depression. Individuals, including IS can experience depression in diverse ways, such as persistent sadness, loss of interest in activities, changes in appetite or weight, difficulty concentrating, and feelings of hopelessness (World Health Organisation, 2023). In the case of IS, these symptoms can severely impact academic performance and social interactions which may further worsen the stress and isolation experienced by these students (Kivelä, et al., 2024; Riboldi, et al., 2023).

It seems like the more adaptable our minds are, the better we can handle stress and avoid getting overwhelmed by depression. Depression is a prevalent mood disorder and a significant public health concern that is characterized by persistent feelings of sadness, loss of interest, and a range of emotional and physical problems that affect how individuals feel, think, and behave (Berenbaum, 2021; Walsh, 2009). Depression is found to affect individuals of all genders and backgrounds, and can manifest as enduring sadness, guilt, disturbed sleep, poor appetite, fatigue, and cognitive impairments. Although, the disorder is treatable, some severe cases are found to result in serious impairments in social, occupational, and personal functioning, and leading to reduced productivity, high treatment costs, and even suicide (Berenbaum, 2021; Stringaris, 2017). Among international students in the UK, depression have been found to be pervasive as around 34.6% postgraduate public health students in England, with

significant associations found between depressive symptoms and socio-demographic factors like ethnicity, funding sources, and accommodation status (Hosseinpur, et al., 2023).

Another study by Ejim et al. (2021), focusing on postgraduate international students in the UK found that 43% of participants experienced depressive and anxiety symptoms, with many of the stressors emanating from relationship issues, financial difficulties, and lack of social support. Despite these challenges, studies show some international students in the UK are less likely to seek formal mental health support and rely more on informal help from friends. These findings showcases the cultural differences in coping mechanisms and support-seeking behaviours of international students (Magnusdottir & Thornicroft, 2022).

Recent research suggests there is a strong connection between cognitive flexibility and mental well-being (Davies, et al., 2024; Ronkainen, et al., 2024; Wei, et al., 2019). Dennis and Vander Wal, (2009) described cognitive flexibility (CF) as the mental ability of individuals to switch between thinking about two different concepts or to think about multiple concepts simultaneously. In the same vein, Liu and Wei (2020) and Mather and Sutherland (2011) considered CF to be a mental agility and coping ability that allows executive functioning that enable individuals to adapt to new or unexpected situations and effectively manage multiple tasks, These mental ability is however essential to international student, due to their need for problem-solving, learning, and adaptation to culture and environmental changes. Studies shows that individuals with high cognitive flexibility (CF) are better equipped to cope with stress (Dennis & Vander-Wal, 2009; Wei, et al., 2019). These set of individuals find alternative solutions to problems, view challenges from different perspectives, and recover more quickly from negative encounters. However, in contrast to population with high cognitive flexibility, those with low CF are found to struggle to adjust to new situations, becoming fixated on negative thoughts and feelings (Dennis & Vander-Wal, 2009). This rigidity in thinking can worsen their stress response, leading to increase in their vulnerability to depression (Dennis & Vander-Wal, 2009). This coping ability and mental agility is particularly needed by international students who are trying to adapt to their new environment and its peculiar stressors (Liu & Wei, 2020). These findings show the need to investigate the factors that contribute to the cognitive flexibility state of international students, so as to be able to design tailored mental health support services for them, which will address their unique challenges and promote well-being.

There are studies to support that stressful life events triggers psychological and physiological responses that, if prolonged, can lead to depression; many of which have been linked to impair cognitive flexibility. Several studies have been carried out on these relationships such as SLE and depression (Hetolang and Kennedy, 2018; Kendler et al., 1999; Kessler, 1997), SLE and CF (Alsaif, et al., 2024; Murphy-Gary, et al., 2022). However, many of these studies either focus on one or more of other variables, or focus on other study population. Therefore, this study combines these variables, to ascertain if SLE and Depression predicts CF among international students.

In the context of international students, adjusting to a new cultural and academic environment may overwhelm their coping mechanisms (CF), which may further exacerbate their risk of depression. The coping mechanism such as seeking social support, reappraising stressful situations positively, and maintaining a problem-solving orientation can help reduce the perceived intensity of stressors and lower the likelihood of developing depression (Liu & Wei, 2020). However, IS with lower CF may be more prone to maladaptive coping strategies, such as avoidance, rumination, negative self-talk and so on, which may intensify their stress experience and also increase their risk of depression (Dajani & Uddin, 2015; Kube, et al., 2020). An understanding of the relationships between these variables can be useful developing interventions, particularly ones that support international students in managing stress and maintaining their mental health.

Numerous studies have highlighted the significant role of stressful life events as precipitating factors for depression. Severe stressful life events are reported to precede approximately 70% of first

episodes of depression and 40% of recurrent episodes (Monroe & Harkness, 2005). Depression, also clinically known as major depressive disorder (MDD), is a pervasive mental health condition characterised by persistent feelings of sadness, suicidal ideation, hopelessness, lack of interest or pleasure (anhedonia) in nearly all activities, significant weight change, psychomotor agitation or retardation and cognitive impairment (Dworkin & Gitlin, 1991; Pagonabarraga, et al., 2023; Strakowski & Nelson, 2015). Unlike temporary emotional responses to life's challenges, depression is a chronic condition that significantly impacts an individual's daily functioning and quality of life (Knight, et al., 2020; Rosińczuk & Kołtuniuk, 2017).

MDD has been known to be a multifactorial disorder with different causes and risk factors which may be genetic, biological, psychological, and environmental. Several studies have found a hereditary component to depression, with significant relationship between family history of depression and increase the risk of developing the condition (Flint, 2023; Lu, et al., 2023). Asim et al. (2023), Cui et al. (2024) and Hassamal (2023) studies have shown that neurons imbalances in neurotransmitters such as serotonin, norepinephrine, and dopamine are linked to depression. These studies suggest that structural and functional abnormalities in brain regions like the hippocampus, amygdala, and prefrontal cortex also play a role in the depressive state of individuals. Berk et al. (2023) in their study acknowledge that populations with existing medical conditions such as diabetes, heart disease, cancer and other neurodegenerative disorders, are often associated with higher rates of depression. Then again, high level of comorbidity is noted to be associated with more adverse health outcomes, reduced treatment adherence, increased mortality, and greater health care utilisation and costs. Studies have also found association of some personal traits such as pessimism, low self-esteem, and high levels of self-criticism with higher risk of depression (Klein, et al., 2011; Ndegemu, 2023; Smith, et al., 2022).

Findings have shown that environmental stressors, such as traumatic events and chronic stress, can trigger depression, particularly in individuals with a genetic predisposition (Agid, et al., 2000; Tafet & Feder, 2021; Tennant, 2002). Environmental stressors have been shown to impact some regions and hormones in the brain that exhibit neuroplasticity, including, the amygdala, anterior cingulate cortex (ACC), hypothalamic–pituitary–adrenal (HPA) axis of the brain. The Amygdala, located within the temporal lobe, processes emotions, particular in detection of fear and threat, and plays a role in forming emotional memories. This part of the brain is responsible in regulating emotions, decision-making, and cognitive control. It functions particularly in assessing and responding to emotional and social information. ACC functionalities contribute in individuals' modulation of stress and adaptive coping strategies (Russell & Lightman, 2019; Tafet & Feder, 2021).

Past experience, especially negative events, contribute to changes in the ACC such as childhood trauma and other adverse experiences. These stressors have been linked to structural changes in the brain, impacting regions like the amygdala and anterior cingulate cortex (ACC) of the brain (Jeong, et al., 2023). The changes manifest by inducing the structural neuroplasticity of both regions i.e ACC and HPA, leading to altered synaptic connectivity and heightened stress responsivity (Jeong, et al., 2023; Li & Odell, 2023). There are also evidences that these interchange between environmental stress and genetic factors, such as polymorphisms in genes like SERT, BDNF, and GR increase depressive disorders vulnerability (Ding & Dai, 2019; Silva, et al., 2021; Tafet & Feder, 2021). For instance, Scorza et al. (2020) and Silva et al. (2021) also found that both positive and negative experience can result in epigenetic modification. This is a process in which these experiences such as malnutrition or environmental toxins can cause temporary or permanent change in the chemistry (genomic methylation) and histone acetylation patterns within neuronal cells that encodes genes in brain cells. These modifications and chemical alterations on histone proteins, DNA, and RNA molecules impacts gene expression without altering the DNA sequence (Gómez de Cedrón, et al., 2023). Also, studies by Kanes et al. (2023) and Russell & Lightman (2014) have reported that stress may lead to deregulation of the hypothalamic–pituitary–adrenal (HPA) axis of the brain, especially chronic stress, whether experienced

in childhood or adulthood, thereby contributing to depressive symptoms through altered neurotransmission and brain structure.

The link between these SLE and depression is well-documented across various demographics and cultural contexts. The relationship is often bidirectional: while stressful events can trigger depressive episodes, individuals with depression may also perceive and react to life events in ways that exacerbate their stress (Bjørndal, 2023; Grant, et al., 2004; Kim, et al., 2003). For example, research involving Chinese college students demonstrated a strong positive correlation between the number and intensity of stressful life events and the prevalence of depression (Wei, et al., 2019). Examining how stressful life events impact sleep problems in 513 Chinese freshmen, Liu et al. (2023) found that depressive symptoms partially mediate this connection, while emotional regulation skills might act as a moderator, influencing the degree to which stressful events trigger sleep problems through depression.

Study conducted by Niroula & Silwal (2022) utilised the Social Readjustment Rating Scale (SRRS) and the Beck Depression Inventory (BDI) to evaluate the severity of stressful life events (SLE) and depressive symptoms in a cohort of 237 consecutive patients diagnosed with ischemic heart disease (ICD) in Nepal. The study finds significant correlation between the intensity of depressive disorders and the severity of stressful life events. The result reveals the predictive nature of psychological stressors and depressive symptomatology in this patient population. These findings reveals that both the objective and subjective aspects of stress are worth considering, as the same event may have different impacts depending on an individual's prior experiences, personality traits, available support systems, and genetic and cognitive makeup. Given that SLEs appear to trigger a significant portion of depression cases, both initial and recurring, it is crucial to consider them in managing depressive disorders. This is especially important due to their potential impact on the course of illness and even suicide risk.

Cognitive Flexibility

Studies on the relationship between stress and depression development of depression is well-established. However, the precise nature of this connection remains a topic of on-going exploration. Multiple studies examining population exposed to severe stress reports a positive correlation to depression and other clinical symptoms, with many of the findings revealing a cumulative impact of stressful life experiences, implying that greater exposure leads to more severe MDD. However, seemingly contradictory evidence exists. Other studies report a negative correlation between exposure and symptoms (Baugerud, et al., 2018; Nuttman-Shwartz, 2014; Vang, et al., 2020). This suggests a potential habituation effect, where individuals exposed to repeated stressors may develop coping strategies – a degree of tolerance to mitigate negative consequences. These mixed results and findings show the complexity of the relationship between SLEs and depression in which individual's adopted coping strategy may play a predicting effect on their outcomes.

Roger et al. (1993) and Roth and Cohen (1986) categorised coping strategies into the approach-oriented (dealing with the stressor) and avoidance-oriented (escaping the stressor). the approach-oriented coping style, which researchers have further classified as rational (problem-solving, adaptive), includes problem-solving and positive reappraisal, while the avoidance, which is emotional and focuses on feeling, and may involves procrastination and thought suppression is described to be maladaptive and an unhealthy coping style (Elklit, 1996; Stowell, et al., 2001). The approach-oriented is considered adaptive and healthy forms of coping, and it has been hypothesised that cognitive flexibility facilitates use of more adaptive coping (Elklit, 1996).

Several studies have shown that this mixed result could be as a result of the individual differences in cognitive flexibility capabilities. The findings by Kube et al. (2020) and Nuttman-Shwartz (2014) suggests that cognitive flexibility may moderate the relationship between repeated stressful experiences and MDD. The studies revealed that individuals with lower cognitive flexibility exhibit a positive association between exposure and symptoms, while those with higher flexibility do not. Harel et al. (2023) assert that population with high cognitive flexibility opt for coping strategies that empower

individuals to effectively manage challenges, and are characterised by problem-focused or emotion-focused approaches. Conversely, those with lower cognitive flexibility tend to settle towards maladaptive coping strategies. These strategies, such as substance use or avoidance behaviours, offer only temporary relief and can ultimately exacerbate problems (Amenah & Gholamipour, 2023; Harel, et al., 2023).

These observations are indications of the important role that cognitive flexibility play in building resilience in the face of SLEs. A resilience that is much needed by international students considering the possible cultural and psychographic differences. By facilitating the adoption of adaptive coping mechanisms such as cognitive flexibility, international students can manage stress and its consequent depression effectively. Doing so can also moderate the risk of depression and promoting psychological well-being. This study, therefore, anticipate similar predicting effects of cognitive flexibility on the relationship between SLEs and MDD symptoms in international students.

Conclusion

This study has explored literatures on the nature of stressful life events (SLEs), depression, and cognitive flexibility. Through existing literature and empirical evidence, we have highlighted the significant impact of SLEs on mental health, particularly how these stressors can result in depression and other psychological disorders. This relationship is especially pertinent for international students, who face unique challenges and stressors associated with adapting to a new cultural and academic environment.

Given the significant contributions of IS to the UK's economy, cultural, and academic landscape, it behoves relevant organisations, especially stakeholders in tertiary institutions, to ensure their well-being. Therefore, this study aims to explore how stressful life events and depression impact cognitive flexibility among international students at the Nottingham Trent University. By identifying the factors that influence cognitive flexibility, the study seeks to inform the development of targeted interventions that can help international students manage stress and maintain mental health. This research not only contributes to the existing body of knowledge on mental health and cognitive functioning but also has practical implications for university policies and support services aimed at fostering a supportive and inclusive environment for international students.

3 METHODOLOGY

The population for this study comprises all international students enrolled at Nottingham Trent University during the 2023/2024 academic year. The study involved a total of 62 participants, drawn from international students at Nottingham Trent University. Out of the 62 participants, 42 provided complete and valid responses, while 20 responses were incomplete and thus excluded from the analysis, representing a 67.7% response rate. Regarding gender distribution among the valid responses, 30 participants identified as male, making up 71.4% of the valid sample. The remaining 12 participants identified as female, constituting 28.6% of the valid sample. The age distribution among valid responses varied widely, with the most common age being 22, representing 35.5% of the sample. Other ages were distributed from 20 to 58 years, and the mean age calculated at approximately $M_{age}=26.08$, $SD=0.86$ (see Table 1). This study received approval from the university's ethics committee. Participants were recruited through personal networks and referrals, social media platforms, and WhatsApp Groups. To be included in the study, participants had to be at least 18 years old, agree to participate voluntarily, and have no visual, auditory, or cognitive impairments that might interfere with their comprehension of the study's objectives. This is because some of the adopted measuring scales have been shown to not have adequate internal consistency with subjects suffering from mental retardation (Sepehry, 2014). The diverse sample provides richer dataset that will help increase the external validity and enhance the research finding (Brown, *et al.*, 2023; De Beuckelaer, *et al.*, 2012).

Data was collected using three primary instruments; the Perceived Stress Scale (PSS): A standardised questionnaire by Cohen *et al.* (1986) measuring perceived stress is used to measure the frequency and impact of various stressful life events experienced by participants. The PSS offers a psychometrically robust and efficient means to assess individual appraisals of stressfulness in daily life. This 10-item questionnaire boasts a strong internal reliability $\alpha = 0.840$ (see appendix), making it an appropriate tool for investigating the relationship between perceived stress (SLEs) and the emergence of MDD concerns (Cohen, 1986; Lee, 2012). The 10-item PSS, each question is scored from 0 to 4, with 0 indicating "never" and 4 indicating "very often", and therefore has a minimum score of 0 and a maximum score of 40. PSS quantifies the extent to which international students perceive their lives as unpredictable, uncontrollable, and overwhelming. The PSS report more efficiency in predicting SLE in college students, particularly in the case of depressive and physical symptomatology, with reliability score $>.70$, which is considered a minimum measure of internal consistency (Cohen, *et al.*, 1983; Lee, 2012).

Zung Self-rating Depression Scale according to Zung (1965) is a widely used self-report inventory assessing the severity of depression symptoms. Several studies and authors have adopted this scale to obtain reliable findings, with Zung reliability (Cronbach alpha) of 0.84 (De & Baneke, 1989). The scale evaluates depressive illness by focusing on behavioural and somatic symptoms (Carroll *et al.*, 1973). According to Huang & Wong, (2014), the SDS has been utilised in various countries, with cross-cultural validation studies conducted in Dutch, Finnish, Hmong, and Japanese populations, proving to be an efficient tool collecting data of self-report depression.

Cognitive Flexibility Scale (CFS) evaluates the cognitive flexibility of populations. Particularly their ability to adapt to new and changing situations. A 20-Item Cognitive Flexibility Inventory (CFI) scale by Dennis and Vander-Wal (2009) was adapted. The internal consistency reliability of the scale, as measured by Cronbach's alpha, was found to be excellent at $\alpha = 0.930$ (see Appendix). This result aligns with the reliability estimates reported in previous research using the same instrument (Bernardo & Presbitero, 2018; Dimayra & Santiago, 2023).

Procedure

Data collection was conducted within 6-week period. Purposive and snowball sampling techniques is used to target respondents for the study. Participants were invited to participate in the study through various channels, including face-to-face contacts (colleagues), and digital platforms such as WhatsApp Group. Eligible participants were sent the QR code and a hyperlink and to complete the online survey via Qualtrics. Researchers, including psychologist, recognise qualtrics as a user-friendly, secure, and versatile platform for collecting data for various research fields (McEwan, 2020; Permut, *et al.*, 2019). Its ease of use, data security, and built-in analysis tools make it a valuable tool for researchers of all experience levels. The respondents followed the link to access questionnaire items that measure their Depression, Stressful Life Events, and Cognitive Flexibility. Participant were generated unique IDs, acknowledge the understanding of their rights, and give consent for the use of the data for the research purpose, before proceeding with the study. The study adhered to ethical guidelines for research involving human subjects. Approval was obtained from the Nottingham Trent University Ethics Committee prior to data collection. Participants were informed about the study's objectives, procedures, potential risks, and benefits. Prior to data collection, informed consent was obtained from all participants. This is to ensure that the purpose of study and their rights are elucidated, including their right to withdraw at any time.

Collected data was analysed using Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics including frequency counts, simple percentages and SD were calculated to summarize the demographic characteristics of the study population. To test the hypothesis, Pearson correlation coefficients were used to examine the relationships between stressful life events, depression, and cognitive flexibility, and multiple regression analysis was conducted to determine the predictive

value of stressful life events, depression and their interaction (SLEs Score * Depression Score) on cognitive flexibility.

4 DATA ANALYSIS AND DISCUSSION OF FINDINGS

4.1 Data Analysis

Table 1 shows that the mean age was 26.08 years (SD = 0.86). Of the participants, 71.4% were female and 28.6% were male. The mean depression score was 40.68 (SD = 8.10, range 20-61). The average number of stressful life events was 29.71 (SD = 6.98, range 10-41), and the mean Cognitive Flexibility Index score was 88.94 (SD = 22.19, range 20-111). This data show that the cognitive flexibility index of international students was relatively high, with a moderate level of depression and stressful life events.

Table 2 presents the intercorrelations among the study variables. Significant correlations were observed as Depression was positively correlated with Stressful Life Events ($r = .438$, $p < .01$) and the Cognitive Flexibility Index ($r = .383$, $p < .05$). Stressful Life Events showed a strong positive correlation with the CFI ($r = .744$, $p < .01$). This reveals that higher levels of depression are associated with more stressful life events and lower cognitive flexibility. Also, stressful life events are strongly linked to better cognitive flexibility. These findings suggest that interventions targeting stress management and cognitive flexibility may help mitigate depression.

Table 1

Participant Demographics and Clinical Features (N=62)

Variables	n (%) or (M ±SD)	Minimum	Maximum
Age	26.08±0.86		
Sex			
Female			
Male	30 (71.4%) 12 (28.6%)		
Depression	40.68±8.10	20	61
SLEs	29.71±6.98	10	41
CFI	88.94±22.19	20	111

Note. N= number of participants; SD = standard deviation; Depression = Zung's Self-Rating Depression Scale; SLEs = Stressful Life Events; CFI = Cognitive Flexibility Inventory (CFI)

Table 2

Correlations among Depression, Stressful Life Events, and Cognitive Flexibility Index

Variable	N	M(SD)	1 (p)	2(p)	3(p)
Depression	40	40.68 (8.10)	-		
SLEs	38	29.71(6.98)	.438** (.006)	-	
CFI	35	88.94(22.19)	.383*(.023)	.744**(<.001)	-

Note. N= number of participants; SD = standard deviation; Depression = Zung's Self-Rating Depression Scale; SLEs = Stressful Life Events; CFI = Cognitive Flexibility Inventory (CFI).

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

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

Regression Analysis on the Impact of Stressful Life Events and Depression on Cognitive Flexibility (CFI) among International Students in the UK

Table 3 Descriptive Statistics and Correlations

Variable	Mean	Std. Deviation	Pearson	Sig. (1-tailed)
CFI	98.8857	19.92747	1	
Depression	40.3143	8.19889	-.431	0.005
SLEs	27.8000	4.56843	-.080	0.324
Interaction	1137.4857	344.84083	-0.296	0.042

Source: Result (2024)

**Table 4
Model Summary**

Model	R	R Square	Adjusted Square	R Std. Error of the Estimate	df1	df2	F	Sig.
1	.773 ^a	.598	.559	14.72899	3	31	15.391	.000 ^b

Note. a, b Predictors: (Constant), interaction, Depression, Stressful Live Events;

**Table 5
Coefficients**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	CI (LB, UB)	VIF
	B	Std. Error	Beta				
(Constant)	-48.422	37.906		-1.277	.211	125.731, 28.887	
SLEs	4.364	1.296	1.384	3.367	.002	1.720, 7.007	13.031
Depression	1.813	.978	.611	1.854	.073	-.181, 3.806	8.380
Interaction	-.054	.031	-1.034	-1.726	.094	-.118, .010	27.713

Note. SLE= Stressful Life Events; CI = 95.0% Confidence Interval for B; LB= Lower Bound; UB= Upper Bound; CS= VIF=Variance Inflation Factor

The multiple regression analysis provides insights into how stressful life events and depression, both individually and interactively, influence cognitive flexibility among international students in the UK. The model summary in Table 4 revealed that the inclusion of Depression, SLEs, and their interaction (Depression * SLEs) term explains 59.8% of the variance in cognitive flexibility ($R^2 = 0.558$). This suggests that these predictors collectively have a significant influence on cognitive flexibility. Also, the model was statistically significant, with $F(3,31)=15.391$, $p<0.001$, an indication that at least one of the predictors is significantly related to CFI.

As shown in Table 5, Stressful Life Events had a significant positive effect on CFI ($\beta = 1.384$, $p=0.002$) among the predictors. This indicates that increased levels of Stressful Life Events are associated with higher CFI scores. Conversely, Depression had a marginally significant positive effect on CFI ($\beta = 0.611$, $p=0.073$), suggesting a trend where higher levels of Depression are associated with increased CFI, although this effect was not statistically significant at the conventional $p<0.05$ level. The interaction term between Stressful Life Events and Depression showed a marginally significant negative effect on CFI ($\beta = -1.034$, $p=0.094$). This suggests that the combined effect of higher Stressful Life Events and Depression tends to decrease CFI, though this finding was also not statistically significant at the $p<0.05$ threshold. The study Collinearity statistics revealed high Variance Inflation Factor (VIF) values (Stressful Life Events= 13.031; Depression=8.380), particularly for the interaction term (27.713), indicating potential multicollinearity issues.

4.2 Discussion of Findings

International students were under focus in this study. The study investigates whether stressful life event and depression predicts cognitive flexibility among the students. The study tested three hypotheses: i.e whether stressful life events predict cognitive flexibility; whether depression predicts cognitive flexibility, and lastly, whether the interaction between stressful life events and depression predict cognitive flexibility among the students. The findings of this study contribute significantly to our theoretical understanding of the nexus between these variables. Practically, these results reveal the importance of early intervention strategies that target not only depressive symptoms but also cognitive flexibility to prevent and mitigate the impact of stressful life experiences.

4.2.1 Stressful Life Events and Cognitive Flexibility

The results indicate that stressful life events have a significant positive correlation between SLEs and CFI, $r(35) = .744$, $p < .001$; and impact ($\beta = 1.384$, $t(31) = 3.367$, $p = .002$) on cognitive flexibility. These demonstrate that a higher number of stressful life events is strongly associated with higher cognitive flexibility. Therefore, H01 is supported that Stressful life events significantly impact cognitive flexibility. The findings align with existing findings such as (Soytürk and Akdeniz, 2023) which found that stressful life events (SLEs) do not significantly impact cognitive flexibility (CF) among students. SLEs, encompassing experiences such as relocation, cultural adjustment, and academic pressures, demand considerable psychological adaptation (Compas, 1987; Johnson, 1982). Also, similar relationships in different populations was observed that positive correlation exist between SLEs and depression Huang *et al.* (2022); Niroula and Silwal (2022), who identified similar relationships in different populations. Studies have shown that chronic exposure to stress can lead to a diminished CF, as individuals become more rigid in their thinking and less able to adapt to new situations (Dennis and Vander Wal, 2009). This rigidity exacerbates the stress response, further increasing vulnerability to depression (Kube, *et al.*, 2020). This finding shows the need for targeted interventions that enhances CF to help international students cope with the unique stressors they face.

4.2.2 Depression and Cognitive Flexibility

The results show that depression severity has a marginally significant positive relationship with cognitive flexibility, $\beta = 0.611$, $t(31) = 1.854$, $p = .073$. There is also significant positive correlation between Depression and CFI, $r(35) = .383$, $p = .023$, indicating that higher levels of depression are associated with higher cognitive flexibility. Although this relationship is not statistically significant at the conventional .05 level, the Beta ($\beta = 0.611$) suggests a trend. Therefore, H02 “*There is a significant relationship between depression severity and cognitive flexibility in international students in the UK*” is not fully supported but indicates a potential trend. This finding contrast with some existing literature that finds detrimental effects of depression on various cognitive functions, and that it is typically associated with cognitive rigidity and impaired executive function (Austin *et al.*, 2001). Depressive symptoms such as persistent sadness, hopelessness, and cognitive impairments can severely impact an individual's ability to think flexibly (Dworkin and Gitlin, 1991; Pagonabarraga *et al.*, 2023). This finding is in line with previous research by Dennis and Vander Wal (2009) and Liu and Wei (2020), who demonstrated that lower CF is associated with higher depression levels. However, it is possible that in a population of international students, those experiencing mild to moderate depression, as witnessed in this study ($M=40.68$; $SD = 8.10$, range 20-61), may develop flexible thinking as a coping mechanism to handle their challenges (Hemi *et al.*, 2023; Hu *et al.*, 2022; Shiratori *et al.*, 2024).

4.2.3 Interaction of Stressful Life Events and Depression on Cognitive Flexibility

The interaction between stressful life events and depression on cognitive flexibility was marginally significant, $\beta = -1.034$, $t(31) = -1.726$, $p = .094$. While this finding does not reach conventional levels of statistical significance (.05), this finding suggests a trend where the combined effect of stressful life events and depression might decrease cognitive flexibility. Therefore, H03 is not

fully supported but indicates a potential interaction effect worth further exploration. The interaction between SLEs and depression significantly influencing CF further supports the multifaceted impact of these stressors on mental health. The study corroborates the findings of Kube *et al.* (2020) and Nuttman-Shwartz (2014), suggesting that individuals with high CF are better equipped to manage stress and mitigate depressive symptoms. Conversely, those with low CF are more likely to experience exacerbated negative effects from SLEs and depression. In similar study, Huang *et al.* (2022) found that stressful life events directly contribute to depression, which further demonstrate that these factors stress indirectly increase depression risk by impairing cognitive flexibility. This interaction indicates that enhancing CF could be a protective factor against the detrimental effects of SLEs and depression. Also, the development of CF has the potential as interventions to improve CF, in order to build resilience and better mental health among international students.

5 SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

Given the significant contributions of international students to the UK's economy and cultural landscape (Hillman, 2023; Tsiligiris and Ilieva, 2021), it is important that host universities, policymakers and other relevant stakeholders in the tertiary education sector prioritise the mental health and well-being of the international students. Moreover, fostering a supportive and inclusive environment that minimizes cultural and social isolation can help mitigate the negative impacts of SLEs and depression. Universities should also consider providing resources and training for faculty and staff to recognize and support students experiencing mental health challenges.

Despite the significant findings and contributions of this study, several limitations are acknowledged. Another is the multicollinearity among the predictors observed, as indicated by high Variance Inflation Factor (VIF) values, may affect the stability and interpretation of the regression coefficients. This study's considered cognitive flexibility as a single cognitive outcome, which overlook other important cognitive processes that can be affected by stress and depression. Cognitive flexibility is just one aspect of executive functioning, and other components, such as working memory, inhibitory control, and cognitive processing speed, might also be impacted. A more comprehensive assessment of cognitive functioning could provide a deeper insight into the cognitive consequences of stress and depression among international students. Also, the cross-sectional design of the study limits the ability to draw causal inferences. While the correlations between stressful life events (SLEs), depression, and cognitive flexibility (CF) are significant, direction of these relationships were not determined. This restricts our understanding of how these factors interact over time and the long-term impact on international students' well-being. Also, longitudinal studies would be necessary to explore the causal pathways and the potential bidirectional influences between these variables.

5.2 Conclusion

Based on the findings, several conclusions are drawn. The study concludes that SLEs and depression significantly affect CF among international students. The positive correlation between SLEs and depression align with existing findings showing the impact that stress can have on the mental health of college students. However, the findings also show that Depression does not significantly predict CF, but SLE does. International students, who often face unique stressors such as cultural and academic challenges, are particularly vulnerable to these effects. The findings go to show the need for mental health support tailored to the needs of international students to mitigate these stressors.

Although, statistically not significant, the inverse impact observed in the relationship between depression and CF suggests that depressive symptoms not only impair emotional well-being but may also hinder proper cognitive functioning of international students. This cognitive impairment can make worse the challenges that international students face. This experience could make it harder for them to

adapt and succeed academically and socially. Therefore, institutions in the UK may need to address depressive symptoms in their international students through appropriate interventions that can help the students to improve their cognitive flexibility and overall well-being.

The interaction between stressful life events and depression on cognitive flexibility further emphasises the compounded impact of these stressors on the international students. This finding suggests that interventions should not only be focused on stress reduction and depressive symptoms independently, but rather stakeholders may also need to consider the combined effects of the stressors. This can serve as a protective factor that may help international students better manage stress and mitigate the impact of depression.

5.2 Recommendations

Further research is needed to explore the long-term impact of stressful life events and depression on cognitive flexibility. This is needed to evaluate the effectiveness of interventions aimed at enhancing cognitive flexibility as such longitudinal studies can provide insights into the on-going mental health needs of international students and the best practices for supporting them.

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