

**The Relationships Between Depression, Temperament, Character, and Resilience
Among University Students**

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Declaration

I, **Sherlinka Naidoo**

(**u14088267**), hereby declare that this mini dissertation, **The Relationships Between Depression, Temperament, Character, and Resilience Among University Students**

, is my own work except where I used or quoted another source, which has been acknowledged and referenced. I further declare that the work that I am submitting has not previously been submitted for another degree or to any other university or tertiary institution for examination.



Sherlinka Naidoo

Signed on the 27 of August 2021

Ethics Statement

I, Sherlinka Naidoo

(u14088267), have obtained the applicable research ethics approval for the research titled **The Relationships Between Depression, Temperament, Character, and Resilience Among University Students**

on 5 November 2020 (reference number: HUM006/1020) from the Faculty of Humanities Postgraduate Research and Ethics Committee at the University of Pretoria.

Abstract

The increasing prevalence of depression and experiences of depression among students has received research attention both globally and within the South African context. University students encounter diverse challenges. They are in a transitional phase as they navigate new academic demands, newfound independence, social dilemmas, and financial stress while abstaining from familiar and established support systems. Stressors represent unique circumstances contributing to students' vulnerability to depression. Several studies investigated the link between depressive symptomatology and personality—specifically temperament and character - among university students. This study continues with this thread of research by exploring this relationship together with resilience. The study aimed to explore the relationships between depression and temperament, character, and resilience among South African university students. The purpose was to determine the relative contribution of temperament, character, and resilience in explaining depression variance outcomes. Secondary data analysis was conducted on the protocols of 135 South African university students. The assessment battery comprised a socio-demographic questionnaire, Beck's Depression Inventory-II, Predictive 6-Factor Resilience Scale, and the Temperament and Character Inventory-Revised. The data were analysed quantitatively through descriptive statistics, correlational, and multiple regression analyses. The findings indicated significant relationships between specific temperament trait dimensions, character facets, and resilience. Harm avoidance and novelty seeking were dispositional traits, with resilience facets of tenacity, momentum, and collaboration, explaining a considerable variance in depression. The study results emphasised how an understanding of trait and state-related temperament and resilience can inform individualised psychological intervention development for students with prodromal/mild depression.

Keywords: depression; temperament; character; resilience; university students; South Africa

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TABLE OF ABBREVIATIONS

ACC	Anterior cingulate cortex
BDI	Beck's Depression Inventory- II
BDNF	Brain-derived neurotrophic
CAT	Computed axial tomography
CBF	Cerebral blood flow
CBT	Cognitive-behavioural therapy
HA	Harm avoidance
HPA	Hypothalamic-pituitary-adrenal
MDD	Major depressive disorder
MRI	Magnetic resonance imaging
NS	Novelty seeking
PennCNP	University of Pennsylvania Computerised Neuropsychological Test Battery
PET	Positron emission tomography
PFC	Prefrontal cortex
PS	Persistence
RD	Reward dependence
SD	Self-directness
SN	Salience network

ST	Self-transcendence
TCI	Temperament and Character Inventory
VIF	Variance inflation factor
WHO	World Health Organization

Chapter 1: Introduction

1.1 Introduction

This study explores the predictors of the depression symptomatology among university students. It further provides an overview of the current research and its background. Furthermore, this chapter outlines the aims, objectives, and significance of the research. The chapter concludes with the research methodology and dissertation layout.

1.2 Overview

The World Health Organization (World Health Organization [WHO], 2018) defines mental health as an individual's state of well-being, acknowledging their own potential and can, therefore, manage normal daily stresses. The WHO further defines mental health as the ability to work productively while positively contributing to the community (WHO, 2018). An individual can face day to day stressors that impact their mental health. Depression can contribute to poor mental health with a decrease in optimal daily functioning and concomitant influence on life quality. Depression can be defined as a recurrent or chronic disorder. Predicting recurrence and depression chronicity can be clinically important for targeting treatment (Balestri et al., 2019; Paykel, 2022).

University students typically undergo a transition period. They interact within new environments while developing new skills to cope and navigate within new and diverse social networks. For several students, the experience of attending university can be a stressful life event, as students are required to navigate changes in their lifestyle, routine, and social support systems (Bayram & Bilgel, 2008; Ibrahim et al., 2013). As students transition into young adulthood, they enter a transitional phase of significant challenges, including greater independence and the need to navigate life independently (Acharya et al., 2018; Lenz, 2001).

Farrer et al. (2016) elucidated numerous psychological and social stressors encountered by university students, such as academic anxiety, social peer pressure, living away from home, and low confidence levels during assessments. Students encounter these stressors daily, which

could contribute to the aetiology of poor mental health, such as depression (Acharya et al., 2018; Farrer et al., 2016). The aforementioned contextualises the depression risk factors among students, motivating a study of this nature; depression is a pertinent challenge students encounter.

Previous research concentrated on relationships between mood conditions and personality characteristics, focusing on depressive mood within clinical populations (Bajraktarov et al., 2017; Balestri et al., 2019; Lee et al., 2017) and not those within prodromal samples, further reinforcing the significance of this study. This research incorporated Cloninger's psychobiological model of personality, which defines personality as a combination of dispositional temperament traits and character conditions (Cloninger et al., 1993). It is hypothesised that temperament traits may serve as risk or protective factors against depression onset and how depressive mood is experienced. These traits include harm avoidance (HA), novelty seeking (NS), reward dependence (RD), persistence (PS), and character conditions, such as self-directedness (SD), cooperativeness (CO) and self-transcendence (ST) (Cloninger et al., 1993). The psychobiological theory of personality conceptualises personality through a neurobiological framework, implicating diverse brain structures and neurotransmitter systems as substrates of dispositional temperament traits and character conditions (Garcia, Lester, et al., 2020; Lopez et al., 2021).

Resilience is when individuals respond positively to adversity (Rossouw & Rossouw, 2016). Individuals using their social, psychological, and physical resources to discourse adversity while sustaining their well-being are considered resilient (Skrove et al., 2013; Waugh & Koster, 2015). Resilience in students is a crucial skill due to the relationship between resilience and mental health, where facets of resilience have been shown to lower depressive symptomatology (Fernández-Martínez et al., 2017; Skrove et al., 2013). Resilience promotes students' adaptive behavioural and emotional responses to stressors; therefore, resilience is a protective buffer against the development and onset of depression symptoms (Wu et al., 2020).

Rossouw and Rossouw (2016) conceptualise resilience from a neurobiological framework where resilience is dynamic and changeable. From this perspective, resilience can be conceptualised as an individual's ability to adapt while coping with adversity;

neuroplasticity enables this process (Feder et al., 2009; Herrman et al., 2011; Rossouw & Rossouw, 2016; Walker, 2020). Neurobiological networks underlie various resilience facets (Rossouw & Rossouw, 2016), including vision, composure, tenacity, reasoning, collaboration, and health. Understanding students' resilience and various facets can provide insight into how they may cope with contextual stressors and how these skills may mitigate the onset of depressive symptoms.

Limited studies exist on the interplay between student temperament, character, and resilience and the association with mental health and depression. An Australian study on medical students' personality and resilience emphasised two distinct personality profiles. One personality profile was labelled as resilient, owing to combining elevated levels of PS, SD, and low levels of HA. This indicates that their temperament and character profile is associated with their resilience level (Eley et al., 2016). Within the same study, students with high HA, SD, and low PS were characterised as more vulnerable to mental illness (Eley et al., 2016). Hence the importance of incorporating trait temperament, state-related character and resilience, and its relationship with depression among a South African student cohort.

1.3 Justification

Personality characteristics and resilience in relation to depression are important to investigate because of the attributable intersectional relationship, as indicated by research centered on mental health (Balestri et al., 2019). Temperament and character dimensions have been associated with poor mental health and depression outcomes (Bensaeed et al., 2014). Incorporating resilience in this study transposes the focus from the vulnerable individual and fixates on how the individual can positively respond to adversity (Russo et al., 2012). Resilience facets are associated with lower depression symptoms (Skrove et al., 2013).

The focus on a population with a heightened risk for developing depression further justifies this study. Several challenges exist within the South African university context and student counselling services, such as accessibility, limited resources, a lack of support systems, and time constraints in individual counselling (Bantjes et al., 2020; Pillay, 2021). Determining

whether trait-related or state-related attributes predict depressive symptomatology would allow for a better understanding of protective and assumed risk factors. Research findings can facilitate short-term individualised treatment and intervention strategies for students, incorporating dispositional trait profiles and enhancing state-related strengths. These interventions may mitigate the transition from prodromal/subclinical depression to major depressive disorder and help alleviate the burden on student counselling centres.

1.4 Research Question, Aims, and Objectives

The research question relevant to this study:

- Do temperament, character, and resilience predict depression among South African university students?

The study aimed to explore the relationships between depression and temperament, character, and resilience among university students. The study intended to further determine the trait-related (temperament) and state-related (resilience and character) depression predictors.

The study objectives are as follows:

- To explore the depression, temperament, character, and resilience profiles of university students.
- To determine associations between depression, temperament, character, and resilience.
- To determine the relative contribution of temperament, character, and resilience to explain depression variance outcomes.

1.5 Overview of Research Design and Methodology

This study entails a secondary analysis of collected data. The aforementioned objectives are pursued by employing a quantitative correlational research design and regression analysis

to explain the relative contribution of variables to elucidate depression variance. Convenience sampling was used for the original study. The Faculty of Humanities, Postgraduate Research and Ethics Committee, granted ethical approval for the original study on 9 March 2018 by (GW0170723HS). The sample comprised students registered for studies at the University of Pretoria. Descriptive statistics, correlational analyses, and multiple regression analyses were employed in this study.

1.6 Mini Dissertation Structure

- Chapter 1 introduces the study background and rationale. An outline of the research question, the aims, objectives, and research design is provided. The chapter concludes with a layout of the mini dissertation.
- Chapter 2 reviews literature on temperament, character, resilience, and depression among university students, considering the neurobiological underpinnings, and includes a discussion on the psychobiological model of Cloninger (1987).
- **Chapter 3** outlines the research design and methodology, sampling approach, instruments used, and data collection procedure.
- Chapter 4 presents the socio-demographic characteristics. The quantitative results of the data analyses are explored in depth.
- Chapter 5 concludes with an integrated discussion on the extant literature. The strengths and limitations of the study are emphasised, and the chapter concludes with recommendations for future research.

1.7 Conclusion

Numerous studies considered the link between depression, temperament, and character; however, limited studies incorporate resilience as a variable. This study, therefore, contributes to the psychological knowledge base regarding specific trait-related (temperament) and state-related (character and resilience) psychological attributes that may predict depression among South African university students. It may further add to the knowledge base of factors that

predispose individuals to depression, thus contributing to the depression assessment and treatment for student cohorts.

Chapter 2: Literature Review

2.1 Introduction

This chapter summarises the literature on depressive symptomatology among university students, and outlines research on temperament, character, and resilience. Research within the South African context is also reviewed and included. The study aims and objectives guide the literature discussed in this chapter.

This review follows a four-part structure, presenting the reader with a comprehensive overview of the literature, and contextualising the research question of this study. Firstly, this chapter introduces the prevalence of depression among university students. Secondly, this is followed by contextualising the factors affecting depression and its neurobiological underpinning. This contextualisation provides an understanding of depression among an at-risk population within a neurobiological framework. The chapter expands on Cloninger's psychobiological model of personality, followed by a discussion on resilience and its neurobiological framework. This chapter, therefore, incorporates research on all variables within this study (depression, temperament, character, and resilience), concluding with an integrated section to emphasise the interconnectedness of these variables.

2.2 Depression

A mood disorder can be categorised as a mental health problem that persistently affects a person's emotional state (Kessler et al., 1994; Paykel, 2022). Mood disorders can affect an individual's behaviour and their ability to function and navigate daily routine activities. As observed in depression, a person is inclined to experience prolonged extreme emotive conditions, such as sadness and hopelessness (Paykel, 2022). Depressive disorders are the third largest cause of burden disease (WHO, 2018). Burden disease is the influence of a health problem measured by financial cost, mortality, and morbidity. Depression is projected to become the most substantial cause of burden disease by 2030 (WHO, 2018). This punctuates the vast influence of depression on society, emphasising the importance of insight into

depression and its prediction, which can further inform therapeutic and educational interventions for managing depression symptoms.

Mood disorders strongly predict suicidal thoughts, self-harming behaviours, and death in populations globally. The possibility of suicidal behaviour exists during a depressive episode (Paykel, 2022). Depression can be experienced as the continuous feeling of lowered mood or hopelessness (Kessler et al., 1994; Paykel, 2022; Rousseau et al., 2021). Depression is often recognised as a chronic disorder owing to a high relapse rate, with clinical evidence that a third to half of the patients with depression relapse within one year of discontinuing treatment (Demeyer et al., 2012, Kumagai et al., 2019).

The prevalence of depression in 18 to 29-year-old individuals is three times higher than in any other age group (Harkness et al., 2010). Most university students are within this age group. Combined with students' daily stressors, they can be classified as a high-risk group for depression (Van der Walt et al., 2020). The following sections expand on factors affecting university students' mental health.

2.2.1 Prevalence of Depression Among University Students

Depressive symptomatology refers to the somatic, affective, and cognitive symptoms commonly observed within depressive disorders, though absent in a confirmed clinical diagnosis (Paykel, 2022; Rousseau et al., 2021). University students have become a target population for research due to their increased risk of mental disorders and psychosocial stressors (Rousseau et al., 2021), demonstrating a growing concern within psychology (Farrer et al., 2016; Pillay et al., 2020). Research indicates varying depression prevalence levels among university students globally, with a reported level of 8% among Australian university students and 20% among a Pakistani university student cohort (Farrer et al., 2016; ul Haq et al., 2018).

Gress-Smith et al. (2015) further substantiate the high prevalence of depressive symptomatology among individuals within the 18 to 34-year-old age group; this coincides with the ages of students attending university, establishing that 53% of young adults experience depression symptoms in college/university. The prevalence of depression among students in

Africa is equally noteworthy, as a Kenyan study illustrated that one-third of students presented with severe depression (Othieno et al., 2014) and a study conducted in Botswana noted that 8% of the sample reported severe depression levels (Hetolang & Amone-P'Olak, 2018). In a systematic review of international studies on depression among university students, a weighted prevalence of 31% of university students experienced depressive symptomatology (Ibrahim et al., 2013). These study findings attest to the high prevalence of depression experienced among student cohorts.

The national statistics on depression corroborate the prevalence reported in international studies. Researchers established that one in five South African students reported negative cognitions, low self-esteem, low mood, and the inability to manage academic pressures (Pillay et al., 2020). A study on depression and stress among South African medical students established that 26% experience moderate to extreme depression levels (Yigizie & Andualem, 2017). An investigation into the prevalence of suicidal ideations among South African university students and its associations to depression symptoms established that the prevalence of suicidal ideation was indeed more common among South Africa university students than in the general population of South Africa (Bantjes et al., 2016).

Understanding how mental health influences university students further motivated a study of this nature. Literature established that mental health and specifically depression are predictors of academic failure; therefore, the odds of academic failure were increased among students with depression (aOR = 3.69) (Bantjes et al., 2021). The high prevalence reported motivates further research on potential putative risks and protective factors of depression among South African students.

2.2.2 Contextual Factors and Depression Among University Students

Adolescents and young adults typically undergo a transition period, which carries a heightened risk for depression. Students must navigate novel academic challenges, social stressors, and experience increasing autonomy while encountering decreasing parental support. South African students may also encounter unique additional challenges predisposing them to

mental health symptoms (Van der Walt et al., 2020). Uniquely, South Africa students may experience socio-political challenges such as delayed institutional transformation, social inequality, and frequent threats to their personal safety (Van der Walt et al., 2020). Depressive symptoms experienced by students may relate to numerous stressors, such as anxiety about formal assessments and examinations, low confidence levels, poor time management, and inability to balance their academic and social life (Farrer et al., 2016).

The aforementioned stressors, with students studying away from home for the first time, may account for early termination and non-completion of tertiary studies or qualifications (Thurber & Walton, 2012). University students may experience an increased sense of freedom and opportunity for substance misuse, frequently facilitated by a new peer context and financial pressures. The aforementioned factors may contribute to the progression of mental health disorders such as depression (Ibrahim et al., 2013); therefore, several contextual risk factors exist that can contribute to the high prevalence of depression among South African students (van Zyl et al., 2017).

South African students have taken a specific interest in student mental health and have voiced their opinions on suicides at various South African tertiary institutions country-wide (Pillay et al., 2020) marking the social importance of the current study. Depression is a multidimensional disorder, significantly influencing the lives of those experiencing these symptoms (SADAG, 2020). University students' mental health challenges can further be punctuated by poorly resourced student support centres, poor access to timeous interventions, and a lack of institutional capacity to approach the exponential increase in demand for mental health support. These aspects further contextualise the prevalence of depression among the South African student populace, enhancing the need to discuss depressive disorders among young adults.

2.2.3 Neurobiological Theory of Depression

Research from a neurobiological perspective supports the hypothesis that mood disorders such as depression also involve brain pathology. Mayberg (1997) proposed a

neurological theory of depression where recovery requires the inhibition of overactive paralimbic regions and the normalisation of hypo-functioning dorsal neocortical sites. The theory postulates that through the rostral and posterior cingulate, suppression of ventral paralimbic activity causes the disinhibition of the dorsal compartment (Mayberg, 1997). The strong correlation of mood improvement with the dorsal compartment increases, and the ventral compartment decreases supports this theory. Sleep remission (insomnia and hyposomnia) and vegetative disturbances correlated most significantly with ventral paralimbic suppression, and improved cognitive performance tracked primarily with normalisation of dorsal prefrontal hypometabolism (Mayberg, 1997).

The direct anatomical connections of this region to dorsal and ventral presenting changes with treatment further support its crucial regulatory function in modulating the interaction between the dorsal and ventral compartments (Mayberg, 1997). Recovery from depression displays decreases in ventral paralimbic and increases in the dorsal limbic and neocortical regions (Mayberg, 1997). Initiation of transient sadness demonstrates an identical pattern, but in reverse, with increases in ventral paralimbic regions and decreases in the dorsal neocortex. These shifts in the relative relationship between the ventral and dorsal compartments vary the overall mood state. These shifts provide compelling evidence for a reciprocal interaction among these regions in health and disease (Mayberg, 1997).

Further research indicates that major depressive disorder (MDD) links to changes in the hippocampus—specifically functional changes such as the cognitive focus and control. Changes in the neurobiological stress-responsive systems such as the hypothalamic-pituitary-adrenal axis (HPA) and the immune system, occur in MDD (Otte et al., 2016). Neuroscience emphasises the four vital brain regions in emotional regulation (Martin & Ochsner, 2016; Pizzagalli & Roberts, 2022; Singh & Gotlib, 2014): the prefrontal cortex (PFC), the anterior cingulate, the hippocampus, and the amygdala. As a structure, the PFC subserves a person's ability to generate goals, as well as their behavioural responses to achieve these goals. .

These enactments are imperative when conflicting behavioural responses are possible. These can further be dominated and overturned by affective arousal. Research findings suggest this process may be attributed to hemispheric specialisation in PFC function left-sided

activation of PFC regions, integral to goal-directed or appetitive behaviours (Wei et al., 2017). These findings compare to right-side activations of the PFC implicated in avoidance behaviours and inhibition of appetitive pursuits. The aforementioned behaviours can relate to physiological factors and behavioural symptomatology in depressive disorders. The PFC subregions localise representations of behaviours associated with reward and punishment, which can be linked to temperament and character as a crucial variable in this study (Dixon et al., 2017; Strickland & Johnson, 2021).

The anterior cingulate cortex (ACC) is integral in integrating emotional and attentional inputs (Stevens et al., 2011), holding two subdivisions: an affection subdivision in the central regions of the ACC; and the cognitive subdivision related to the dorsal subdivision. The subdivisions connect extensively to multiple other limbic regions and interact with the PFC and cortical regions. It has been hypothesised that the ACC facilitates emotional arousal and control (Stevens et al., 2011) when a novel problem is experienced or when goal attainment is disenchanted. The hippocampus engages in numerous forms of memory and various learning forms, encompassing fear and inhibitory management of the hypothalamic-pituitary-adrenal axis activity (Roddy et al., 2019). Emotional learning acts as a clear link between the hippocampus and the amygdala. The amygdala processes novel significant emotional stimuli and organises cortical responses (Roddy et al., 2019).

Structural brain imaging, such as computed axial tomography (CAT) and magnetic resonance imaging (MRI) scans, are non-invasive methods to appraise the brain, and areas such as cortical and subcortical tracts. The increased frequency of abnormal hyperintensities within the subcortical regions is one of the most consistent irregularities in depressive disorders (Roddy et al., 2019). These often relate to periventricular regions, the basal ganglia, and the thalamus. Individuals with depression may experience reduced hippocampal or caudate nucleus volumes (Mutschler et al., 2019; Respino et al., 2019; Zhuo et al., 2019).

This suggests more defects in pertinent neurobehavioral systems, where illness severity increases because of diffused and focal areas of atrophy, along with increased cortisol levels. The most common positron emission tomography (PET) findings related to depression demonstrate a decreased anterior brain metabolism—often more prominent on the left side

(Holthoff et al., 2004; Pandya et al., 2012). Research further corroborates that depression is allied with an intensification in nondominant hemispheric activity. The reversal of hypofrontality remains common in individuals with depression (Spironelli et al., 2020). Hypofrontality is the decreased cerebral blood flow (CBF) in the brain's prefrontal cortex (Spironelli et al., 2020).

Additional biological studies on depression confirm specific reductions of CBF dopamine innervated tracts of the mesocortical and mesolimbic systems (Bailey et al., 2018). Supplementary research suggests that antidepressants can partially normalise the aforementioned neurobiological changes in individuals with depression (Scholl et al., 2017). Global decrease in anterior cerebral metabolism and increased glucose metabolism correlate with intrusive rumination (Bailey et al., 2018). Intrusive rumination is a cognitive aspect of depressive symptomatology. The concluding neurobiological correlations advance increases in glucose metabolism in several limbic regions, observed in patients with depression with severe recurrent symptoms. This increase is congruent with what is observed within a familial history of mood disorders with reference to depression and depressive symptomatology.

2.3 Cloninger's Psychobiological Model of Personality

According to Evans and Rothbart (2007), the psychobiological model by Cloninger is a commonly studied model of temperament and character (Evans & Rothbart, 2007). Reliability and validity of Cloninger's Temperament and Character Inventory (TCI) were indicated in several studies and across cultures (Adan et al., 2009; Goncalves & Cloninger, 2010; Miettunen et al., 2006). According to the psychobiological model theorised by Cloninger, as measured by the TCI, personality incorporates temperament and character (Cloninger et al., 1993).

The psychobiological personality model combines two interrelated domains: temperament and character traits (Cloninger et al., 1993). According to this model, temperament can be defined as habits and skills based on an individual's perception of external stimuli. Temperament can further be defined as differences in associative learning in response

to reward, novelty and adversity (Cloninger et al., 1993). Temperament is inheritable and refers to an automatic response relating to learning and procedural memory. Hereafter, temperament can be called a trait-related psychological attribute remaining stable over time, owing to its genetic aetiology (Cloninger et al., 1994). The psychobiological model of temperament further partitioned temperament into four dimensions: NS, HA, RD, and PS (Cloninger et al., 1993). The above dimensions encapsulate the individuality of a person's temperament and the emotionally based habitual responses, remaining consistent from childhood to adulthood. First, NS can be defined as the impulsive nature of an individual and a tendency to explore, accompanied by low tolerance and high frustration levels. A stimulus-response exists when a reward is actively pursued or punishment is avoided. This trait may lead to emotional dysregulation and explosive behaviour (Mochcovitch et al., 2012).

Second, HA refers to shyness and pessimistic orientation towards the future. Individuals displaying HA experience fear of the unknown; this fear leads to the avoidance behaviour (Mochcovitch et al., 2012). Third, RD relates to the individual and their fondness for social relationships. If the individual has elevated levels of RD, they may be sensitive to criticism as they pursue external approval. The individual may be sentimental and place importance on their social relationships. Last, PS is attributed to the commitment and perseverance an individual exemplifies to achieve their goals (Mochcovitch et al., 2012).

Character refers to how people relate to others and themselves. It demonstrates individual differences based on what they experienced and learnt. Character traits are not heritable; rather, they originate from life experiences as it is influenced by social learning and life events. Although this does not occur gradually, character traits change during life. The model has since been extended and includes three additional character dimensions (Cloninger et al., 1994); SD, CO, and ST. Self-directedness refers to the individual's ability to regulate and adapt their behaviour depending on the situation (environmental influence).

The individual would need to control their behaviour to ensure it is suitable for the situation while maintaining their goals. Cooperativeness refers to social acceptance, empathy, helpfulness, and compassion (de la Rie et al., 1998). Last, ST is associated with the individual's

spirituality and their perception of how their surroundings are conceived (Cloninger et al., 1994).

2.3.1 Neurobiological principles of the Psychobiological Personality Model

The psychobiological personality model was developed as a neurobiologically-based personality model; the Temperament and Character Inventory-Revised (TCI-R) is the instrument developed to explore the neurobiological substrates of personality. The temperament dimensions of the psychobiological personality model are considered trait related and, therefore, have neurobiological bases. Within the neurotransmitter systems, the temperament traits of NS, HA, and RD linked to low basal dopaminergic activity, high serotonergic activity, and low basal noradrenergic activity, respectively (Cloninger, 1986).

Harm avoidance indicates negative valence linked avoidance learning that takes place passively as well as a heightened sensitivity to behavioural inhibition—often in response to fear invoking stimuli (Cloninger et al., 2019). This response is facilitated by activating the amygdala, subgenual cingulate cortex, and the insular substantia nigra (Paulus et al., 2003; Pezawas et al., 2005; Yang et al., 2009). Harm avoidance is defined by social attachment and a unique activation pattern of dopaminergic neurons in the nucleus accumbens and substantia nigra. This pattern differs from observations in association with NS61 and the oxytocinergic neurons in the hypothalamus (Tost et al., 2010).

Persistence measures individual differences in rewarded behaviours in response to adversity, which are mediated by the brain circuit connecting the nucleus accumbens, anterior cingulate, and ventrolateral frontal cortex (Cloninger et al., 2012; Gusnard et al., 2003). The aforementioned brain circuits contribute to behavioural conditioning and are moderated by regulating the co-expression of two major gene molecular pathways for response to extracellular stimuli: the Ras-MEK-ERK pathway and the PI3K-AKT-mTOR pathways (Zwir et al., 2020; Zwir Nawrocki et al., 2018).

2.3.1.1 Temperament, Character, and Depression

Poor mental health manifestation may be attributed to the interaction between specific temperament traits, character attributes, and their interaction with environmental factors (du Preez et al., 2011). Temperament and character are positively and negatively correlated with mental health (Cloninger et al., 1993). Research findings illustrate that TCI personality features may predict depression treatment outcomes (Balestri et al., 2019). For example, non-remission depression relates to HA and ST and PS and SD in individuals with depression. Harm avoidance, RD, and SD predict non-response to depression treatment; RD, PS, and CO are associated with treatment resistance aimed at alleviating depressive symptomatology (Balestri et al., 2019). A systematic review by Mochcovitch et al. (2012) established correlations between HA (temperament dimensions) and SD (character dimensions) and depressive symptoms.

The study revealed that individuals with a low SD and high HA were more susceptible to depression (Mochcovitch et al., 2012). High SD levels reduced the influence of depressive mood on suicide risk (Lee et al., 2017). The Du Preez et al. (2011) study on South African police trainees identified three personality profiles, demonstrating a link between personality and mental health. The subsequent hypotheses of the study were formulated based on socio-demographic background variables and the influence on mental health and personality characteristics. Second, a specific personality profile would relate to a symptom profile. The third hypothesis is that temperament and character would predict mental health symptoms independently. One of the three personality profiles indicated that high HA combined with low RD, PS, SD, and CO conferred vulnerability to mental health conditions, such as depressive and anxiety disorders (Du Preez et al., 2011). Though the sample in Du Preez et al. (2011) comprised South African police trainees, it still provided an insightful link between psychobiological personality and mental health within a South African context in a cohort with a similar age profile to students.

Further research on the associations between temperament, character and depression indicated that Japanese students who attempted suicide reported high HA compared to other students (Mitsui et al., 2018). The above research findings indicated how both temperament

dimensions (PS and HA) and those of character (SD) could influence mental health outcomes. A Turkish study employing the TCI established that patients with depression displayed higher HA and ST (Celikel et al., 2009); patients with depression also exhibited lower SD and CO scores as compared to healthy control groups (Celikel et al., 2009). This earlier study confirmed that the state dependence of the HA trait and character suggests a relationship between dimensions of the Cloninger model and depression (Celikel et al., 2009; Hansenne et al., 1999). The above discussion emphasises the possible theoretical relationship between temperament traits, character, and mental health, while summarising the possible shared neurobiological substrates of temperament, character, and depression.

2.4 Resilience

Resilience is difficult to define, holding various definitions (Ungar, 2008). The widespread understanding of resilience refers to an individual's skill to acclimatise and adjust when experiencing considerable adversities while preserving physical well-being and good mental well-being. In the recent decade, research on resilience focused on how people exposed to trauma maintain normal physical and psychological functioning (Russo et al., 2012). Ungar (2008) defines resilience as the individual's capacity to navigate psychological, physical, and cultural resources for their well-being.

2.4.1 Resilience and Depression

The research identifies resilience as higher among individuals without depression when compared to individuals who developed a mood disorder, such as depression. Higher resilience levels can be a protective factor for individuals, specifically as a mediator between the individual and the severity of symptoms that may develop (Lamis et al., 2016). Researchers established that high resilience levels could mitigate depression development (Camardese et al., 2014; Kesebir et al., 2013; Kirby et al., 2017) and positively correlate with psychological well-being, whereas they negatively associated with psychological distress (Haddadi & Besharat, 2010). Vulnerabilities can be influenced by various resilience levels, personal

competence, self-esteem, tolerance of negative affect and control (Haddadi & Besharat, 2010). The above research confirms the correlational relationship between resilience and mental health. The above findings have also been replicated among university students.

2.4.1.1 The Relationship Between Resilience and Depression Among University Students.

Resilience is a crucial life skill because of the relationship between resilience, psychological well-being, and mental health in students (Fernández-Martínez et al., 2017). A study in Jordan indicated that 70% of students had depressive symptoms (Hamdan-Mansour et al., 2014). The research findings concluded that depression and perceived social support were significant predictors of resilience (Hamdan-Mansour et al., 2014). University students who experienced higher levels of depressive symptoms were more inclined to report lower resilience levels (Hamdan-Mansour et al., 2014).

In a study in India, the relationship between resilience and depression among university students was explored. Findings indicated that a high level of resilience in students is conducive to improved mental health. High resilience levels lessen the predisposition to experiencing depressive symptoms (Camardese et al., 2014; Ziaian et al., 2012). Resilience is the predisposition to navigate adversity and recovery from situations that may be challenging; depression can often occur in a student with insufficient coping mechanisms and low resilience (Mittal et al., 2018).

According to Meyer et al. (2020), psychological distress caused by depression accounted for a considerable difference (36%) between the high and low resilience groups of university students. Those with low resilience levels reported meaningfully lower levels of social support (provided they are navigating new social networks while away from home), campus integration with regard to connections, and increased levels of psychological distress than students with high resilience levels (Meyer et al., 2020).

These findings emphasise the need for resilience-based interventions to be developed, incorporated, and implemented among university students. Resilience-based interventions focusing on the ability to adapt and improve students' coping responses to early stress may mitigate the transition from prodromal depressive symptoms to clinical depression. According

to Waugh & Koster (2015), when the emphasis is on positive emotions, the individual is assisted by increasing their flexibility and the ability to identify various demands in the environment and employ the appropriate coping strategy.

2.4.2 Neurobiological Resilience Principles

Rossouw and Rossouw (2016) developed a neurobiological resilience scale called the Predictive 6-Factor Resilience Scale (PR6). The domains outlined by the PR6 aligned with resilience scales, such as Davidson dimensions of emotional styles, resilience scale, dispositional resilience scale, and youth resiliency assessing developmental strengths (Rossouw et al., 2017b; Rossouw & Rossouw, 2016). The six domains delineated by the PR6 are vision, composure, tenacity, reasoning, collaboration, and health. Vision includes the feeling of purpose, the ability to set goals, and an overall sense of independence (self-efficacy). This domain is the most important as it assumes that all the other resilience domains are guided by what an individual wants to achieve. The second domain is composure, focusing on emotional regulation and the ability to recognise, comprehend, and respond accordingly to internal cues and physical indicators; the ability to maintain composure and recognise hidden opportunities while solving the problem innovatively (Rossouw & Rossouw, 2016). Tenacity is the third domain and includes perseverance and hardiness, with the ability to learn from mistakes while maintaining realistic optimism. Fourth is the reasoning domain, which includes cognitive skills such as the ability to problem solve and identify available resources (Rossouw & Rossouw, 2016). The ability to remain resourceful when encountering adversity and applying critical thinking is included. Collaboration is the fifth resilience domain, further emphasising the importance of psychosocial interaction and the benefits of support (Rossouw & Rossouw, 2016). Health is an additional domain, which includes physiological health, incorporating regular exercise, nutrition, and sleep hygiene (Rossouw & Rossouw, 2016), and is rarely considered in traditional definitions of resilience (Rossouw & Rossouw, 2016). Regular exercise increases brain-derived neurotrophic (BDNF) and hippocampal function. The second factor within this domain is nutrition; diet influences BDNF regulation. Last, sleep hygiene correlates with stress, sleep, and BDNF levels. The lack of sleep degrades an

individual's higher cognitive functioning while increasing impulsivity (Rossouw & Rossouw, 2016). The resilience assessment device is holistic in conceptualising resilience while including health hygiene factors related to the student context.

Research indicated that the neuroanatomical substrates implicated in depression overlap with brain structures underlying domains assessed in the PR6 (Kupfer et al., 2016; Mayberg, 1997). Neuroimaging indicated that parts of the main brain regions, such as the amygdala, hippocampus, and prefrontal cortex, are affected in patients with depression (Kupfer et al., 2016). The hippocampus and prefrontal cortex play an integral role in the neurological support of the resilience vision domain and are fundamental structures in neuroplasticity—typically disrupted in depression (Liu et al., 2017). The second domain (composure) in the PR6 relates to emotional regulation and the ability to identify, comprehend, and respond physical and internal cues.

The neurobiological structures relate to the ability of the insula to efficiently read and infer signals from the hypothalamic-pituitary-adrenal axis (Davidson & Begley, 2013). This sense of self-awareness is manifested by increased emotional granularity. An increased emotional granularity and a positive disposition improve physiological health, which may not be evident in individuals with depression (Tugade et al., 2004). The aforementioned elucidates the potential intersectional relationship between depression and resilience based on the neuroanatomical substrates underlying the resilience dimensions and depression symptoms.

2.5 Temperament, Character, Resilience, and Depression

Temperament and character correlate to depressed mood. A study explored personality concerning temperament and character and depressive mood among the normal population. The authors established that HA and SD closely relate to the depressive mood in the depressive and normal populations (Richter et al., 2003). Variations in HA and SD account for fluctuations in the level of depressive mood, correlating with age and gender factors (Richter et al., 2003). According to this observation, a bidirectional relationship exists between the personality

variables, and, therefore, changes in temperament and character dimensions cause deviations in a depressed mood.

In a study on 4355 participants examining the relationship between temperament and character and resilience, correlations between the dimensions of the TCI and the Conner–Davidson Resilience Scale (CD-RISC) indicated that resilience was positively correlated with PS, SD, and CO (Kim et al., 2013); however, HA negatively correlated with resilience (Kim et al., 2013). The above findings are significant as it accounts for the significant association between the trait and state psychological characteristics. The current study includes these variables and depression outcomes, attempting to understand this relationship from a psychobiological/neuroscience perspective. Limited studies have included these variables.

From a neuro-biological perspective, temperament, character, resilience, and depression share underlying neuroanatomical and neurochemical substrates. The prefrontal cortex is a core neurobiological brain structure implicated in individuals with depression; abnormally low activity in the prefrontal cortex is identified in individuals with depression (Koenigs et al., 2008). The prefrontal cortex is also crucial in the resilience domain of vision; this domain influences self-worth and goal orientation (Rossouw & Rossouw, 2016). When the amygdala is overactive, an individual is inclined to respond excessively to negative events (Šimić et al., 2021).

The amygdala influences an individual's response (physiological and behavioural response) to emotional stimuli. Brain-derived neurotrophic factor is another neurological structure aiding in the conservation of neurons and synaptic plasticity (Dwivedi, 2009). Evidence suggests that BDNF is involved in depression; therefore, the expression of BDNF is decreased in patients with depression (Dwivedi, 2009). Within the sixth factor of the PR6, hygiene, nutrition, and diet are elements influencing BDNF regulation, which affects sleep and stress (Rossouw & Rossouw, 2016). Neurotransmitters, such as serotonin and dopamine, are crucial in depression development and maintenance.

The neurotransmitter 5-hydroxy-tryptamine (serotonin: 5-HT) function within the brain is important in mood alleviation and sleep regulation (Shabbir et al., 2013). Dopamine, as a neurotransmitter, can cause depression symptoms, such as apathy and emotions of

hopelessness when imbalanced (Costanza et al., 2020). Temperament traits are also linked to the neurotransmitter level within the brain; NS is linked to low dopaminergic activity, and HA is linked to high serotonergic activity (Cloninger, 1986).

The importance of the study is in exploring these relationships among students, typically categorised as a non-clinical sample, or reported prodromal/subclinical depressive symptoms. Understanding the predictors allows for potential insights into factors that may contribute to the transition from prodromal depression to a clinical disorder.

2.6 Student Support and Interventions

From the perspective of depression prevention, understanding university students with mild depressive symptoms as a prodromal population may provide insights into depression. A study was conducted to understand the effects of a Group-Cognitive-Behavioural Therapy (CBT) intervention on depressive levels in individuals with high HA. The results revealed that Group -CBT indicated significant differences between male and female participants in NS, SD, and ST ($P = 0.015$) (Saigo et al., 2018). The group-CBT intervention had changed schemas associated with depressive symptoms. Group-CBT for students with high HA effectively reduced BDI-II scores at one-year post-intervention (Saigo et al., 2018). Interventions targeting temperament traits and positively modifying cognitions can prevent experiences of depression in students.

Resilience was observed as mediating student responses to depression (Wu et al., 2020). Resilience contributes to the students' coping strategies, perceived social support, campus connectedness, and self-esteem. The bidirectional relationship aids in identifying protective factors that can be incorporated to individualise psychological intervention on a clinical and educational level (Wu et al., 2020).

Resilience factors provide valuable insight into students' abilities to cope with depression symptoms (protective factors) or how low resilience levels may contribute to prodromal depressive symptoms and the transition to depressive disorders. A well-established link exists between psychological distress and resilience. Three negative emotional conditions

characterise psychological distress among university students: depression, anxiety, and stress (Tran et al., 2021). Resilience-based interventions may empower students with mental health concerns to cope more efficiently with the demands of tertiary learning (Hartley, 2013). This study provides evidence that a resilience framework may be an important avenue for promoting academic PS in students with mental health concerns (Hartley, 2013).

Resilience can be observed as how a student copes with various stressors; maladaptive coping strategies may lead to depressive symptoms. Resilience is invaluable and can inform intervention on multiple levels within educational, clinical, and professional settings (Rossouw & Rossouw, 2016). Resilience research can aid mental health professionals in increasing resilience interventions among university students and increasing students' capabilities to manage the negative effects of depression. Screening students for psychosocial health indicators, such as resilience, can further enhance the services to students when experiencing prodromal depressive symptoms and clinical depression (Hamdan-Mansour et al., 2014). Students may need to cultivate resilience to navigate university demands; mental health professionals can enhance this with a focus on resilience interventions.

2.7 Conclusion

This chapter explores temperament and character, as proposed in the psychobiological model by Cloninger (1993). The association between temperament, character, and resilience was considered within the context of mental health challenges, particularly depression among university students. Neurobiological overlaps exist between trait (temperament) and state-related (character and resilience) factors and depressive symptomatology. Understanding how these traits and state-related factors may correlate and differentially predict depression symptomatology among students relates to developing specific psychological intervention strategies guided by neuroscience principles. Considering the resource-strained institutional capacity to approach the burgeoning student mental health challenges, focused and efficacious psychological interventions can save time and resource allocation while potentially mitigating the transition from prodromal/subclinical depression to a clinical disorder.

Chapter 3: Research Methodology

3.1 Introduction

Chapter 3 emphasises the research process and how this study was conducted. It describes the research methodology for the quantitative correlational research design. This section further provides insight into the employed sampling method, outlining and describing the assessment instruments used to collect data and the statistical techniques employed for data analysis. Finally, the chapter elaborates on the ethical considerations during this research pursuit.

3.2 Research Aims and Objectives

This study aimed to explore the relationships between depression, temperament, character, and resilience, determining the trait-related (temperament) and state-related (resilience and character) depression predictors.

3.2.1 Objectives

- To explore the depression, temperament, character, and resilience profiles of university students.
- To determine associations between depression, temperament, character, and resilience.
- To determine the relative contribution of temperament, character, and resilience to explain depression variance outcomes.

These hypotheses were proposed for the study:

- Trait-related temperament is a significant predictor of depression in South African students.
- State-related character is a significant predictor of depression in South African students.
- State-related resilience is a significant predictor of depression in South African students.

Null hypotheses applicable to the study:

- Trait-related temperament is not a significant predictor of depression in South African students.
- State-related character is not a significant predictor of depression in South African students.
- State-related resilience is not a significant predictor of depression in South African students.

3.3 Research Design

This study entailed a secondary analysis of collected data. The study was quantitative in nature and incorporated a cross-sectional correlational research design, as well as an analysis of the relative contribution of the independent variables on the variance observed in the dependent variables, through regression models (Gravetter & Forzano, 2011).

3.4 Sample

The study sample comprised of psychology students from a South African university who participated in the original study, titled “*Executive functioning, temperament and resilience and depressive symptomatology among university students.*” The Faculty of Humanities, Postgraduate Research and Ethics Committee, granted ethical approval for the original study on 9 March 2018 (Reference Number: GW0170723HS). A convenience sampling approach was employed in the original study based on potential students’ availability and willingness to participate (Gravetter & Forzano, 2011). Students registered for a psychology module were recruited to participate voluntarily. The choice of psychology students was motivated by managing practical aspects, such as an online assessment platform and scheduling group administration, based on shared availability.

3.4.1 *Sample Characteristics*

The sample comprised students aged between 18 and 25 years who voluntarily participated. A final sample of 135 students was collected. The exclusion criteria for this sample comprised these aspects:

- Diagnosis and treatment of any mental disorders, such as MDD, schizophrenia, bipolar disorder.
- Other medical or neurological illnesses may influence performance on assessments, such as a stroke history, epilepsy, or brain injury consciousness loss.
- Substance abuse within the past three months.

3.5 *Data Collection Instruments*

The data from these measuring instruments were employed in the present study:

- A socio-demographic questionnaire
- Beck's Depression Inventory- II (BDI-II)
- Predictive 6-Factor Resilience Scale (PR6)
- Temperament and Character Inventory – revised (TCI-R)

3.5.1 *Socio-Demographic Questionnaire*

The socio-demographic questionnaire captured participant information on gender, age, first language, and year of study. The socio-demographic questionnaire further sought information from the participants aligned with the exclusion criteria, such as substance consumption and previous and present medical and psychiatric history.#

3.5.2 *Beck Depression Inventory-II*

The Beck's Depression Inventory -II (BDI-II) experienced a major revision in 1996 to include a wider range of depression symptoms. With these revisions, the inventory device aligned closely with the DSM-IV diagnostic criteria for depressive disorders. The 21-item self-report inventory examines depressive symptomatology, and a total score of 63 is calculated from the item responses (Beck et al., 1996). The BDI-II identified state-based depressive symptomatology in adult research participants (Beck et al., 1996). It can also measure the severity of depression symptomatology (Farinde, 2013). The strength of the BDI-II is its ability to delineate depression levels.

A self-rated scale helps evaluate crucial depression symptoms, such as including low mood, pessimistic outlook, sense of failure, guilt, insomnia, fatigue, loss of appetite, and weight loss (Beck et al., 1996). The inventory could be completed timeously as most participants could complete the 21 items of the self-report within a five to 10-minute time span (Farinde, 2013). An added strength of the inventory is that it is user-friendly and easy to understand (Farinde, 2013). The BDI-II was used in the South African context, with reported Cronbach's alpha of 0.84 and test-retest reliability of $r = 0.55$ (Makhubela & Mashegoane, 2016).

3.5.3 *Predictive Six-Factor Resilience Scale*

The PR6 is a scale measuring resilience across six resilience domains. The six factors linked to the neurobiological constituents of vision are composure, tenacity, reasoning, collaboration, and health (Rossouw & Rossouw, 2016). Crucial factors within this scale include the first resilience domain. The PR6 indicated internal consistency, with a Cronbach's α of 0.74 (Rossouw & Rossouw, 2016). The scale is unique as it conceptualises resilience from a neurobiological premise (Rossouw & Rossouw, 2016). The PR6 is a relatively new scale, not being used in the South African context, adding to the knowledge contribution of the current study.

3.5.4 Temperament and Character Inventory-Revised

The Temperament and Character Inventory-Revised (TCI-R) is a 240-item five-point rating scale (1, definitively false; 2, mostly or probably false; 3, neither true nor false nor about equally true or false; 4, mostly or probably true; 5, definitively true). As a standardised self-administered questionnaire, the TCI-R measures four independent, genetically determined temperament dimensions and three character dimensions, supposed to be determined by socialisation and learning through the life of an individual. The TCI-R instructs participants to peruse each statement and mark the statement best relate to them. The TCI-R was developed to assess seven dimensions regarding temperament and character, based on Cloninger's psychobiological model. It is intended to determine the differences between the four temperaments (HA, NS, RD, and PS) and three-character higher-order dimensions (SD, CO, and ST). The internal consistencies across the domains ranged between 0.70 and 0.89 for non-clinical samples (Cloninger et al., 1994). Earlier versions of the Temperament and Character Inventory were used in research within the South African context (Du Preez et al., 2011).

3.6 Data Collection

As this study used secondary data analysis, no new data was collected. Rather, parts of the original study on depression, cognition, temperament, character, and resilience were used. In the original study, data was collected at the University of Pretoria's in 2018. A master's Psychology student and a research assistant collected the data.

The collection process in the original study was as follows: subsequently to ethical approval from the Humanities Postgraduate Research and Ethics Committee at the University of Pretoria, module coordinators were contacted in order to gain permission and authorisation to be uploaded a thorough information sheet on the university Click Up system (intranet). This was done to recruit volunteer participants. The information sheet concisely explained the nature of the study and specified what participation would require.

Students who expressed interest and willingness to participate contacted the researcher through SMS or email. Students had an opportunity to raise questions, and these were then addressed. Student participants that were willing to proceed with the assessment process, were

provided with available time slots to complete the assessment battery. Each participant has the freedom to pick a single assessment session which was reserved based on mutual availability. Student participants were also sent a reminder stating information about the venue closer to the time of the assessment. In the event that student participants could not attend one of the time slots, weekly timetables of both the researcher and the participant were sent to detect a convenient date for all parties. The assessment proceeded as detailed below.

3.6.1 Administration Conditions (Original Study)

The previous researcher facilitated all sessions. Three to 10 students were in assessment sessions at any given time. The laboratory used ensured that the testing environment was conducive to testing as the environment was free of distractions and with standardised testing protocols remained consistent for all groups for all sessions. The Online assessment battery was accessed on desktop computers linked to the University of Pennsylvania Computerised Neuropsychological Test Battery (PennCNP).

Numerical codes were used as unique identifiers for students to log in to the online assessments, as this safeguarded the participant identity and maintained test score confidentiality. The researcher reviewed all demographic information before each session so as to ensure that all participants met the inclusion criteria. Subsequently to completing the online battery (Neuropsychological section and TCI), participants completed the remainder of the assessment battery (BDI-II, BAI and the PR6). Overall, the assessment battery required 45 to 60 minutes, depending on the participant's pace, to conclude.

The current study parameters were conceptualised based on a larger data set. The data collection literature and the instruments were reviewed while determining the appropriate statistical analysis for this study. Data analysis and interpretation were conducted in collaboration with the Department of Statistics, University of Pretoria.

3.7 Data Analysis

The data were analysed through statistical procedures, such as descriptive statistics, Pearson correlation, and stepwise regression analysis. First, descriptive statistics refer to how the data are organised, summarised, and simplified into a more manageable form (Gravetter & Forzano, 2011). Descriptive statistics were used to contextualise the participant socio-demographic information and included descriptive data (means, standard deviations, and range) of scores obtained on the measuring instruments and questionnaires. Correlation analysis explored the relationship between depression (dependent variable) and temperament (independent variable), character (independent variable) and resilience (independent variable). A stepwise multiple regression analysis was employed to identify factors significantly predicting depression outcomes. This technique analysed how adequately one or multiple variables predict the variance in the dependent variable (Treiman, 2009).

Preliminary analyses ensured no infringement of the statistical assumptions of normality and multicollinearity. In multiple regression, multivariate normality is an assumption that assumes the residuals are normally distributed (Humble, 2020). Furthermore, multicollinearity in multiple regression presupposes that the independent variables of a research study are not highly correlated with one another. These assumptions were evaluated using variance inflation factor (VIF) values and residuals (Humble, 2020) before conducting regression analysis.

3.8 Ethical Considerations

The Faculty of Humanities, Postgraduate Research and Ethics Committee, granted ethical approval for the original study on 9 March 2018 (Reference Number: GW0170723HS). In the aforementioned study, all participants were informed of the study's purpose and afforded the information for an informed decision regarding their voluntary participation. Contact details were presented to the participants to ensure all queries were discussed timeously. Altogether, the informed consent guidelines were maintained effectively during the original process of data collection. Participants in the initial study permitted data to be provided for

future research attempts. Confidentiality was continuously maintained as no personal identifiers were used in the protocols and unique identifiers were provided. There were no anticipated or foreseeable risks to participating in the original study. Prior arrangements ensured that psychosocial support was available to participants when necessary.

The data for this study are stored in the Department of Psychology (HSB 11-24) and will be retained for 15 years, according to the University of Pretoria policy. The current study used digital data records without personal identifiers coded numerically. Ethical approval for the current study was granted on 5 November 2020 (Reference Number: HUM006/1020) by the Faculty of Humanities Postgraduate and Ethics Committee at the University of Pretoria (Appendix A: Letter of Ethical Clearance).

3.9 Conclusion

Chapter 3 outlines the sample characteristics of this study and methodology, detailing the measuring instruments/questionnaires and data analysis. Chapter 4 reports on the results from the descriptive and inferential statistical analyses.

Chapter 4: Results

4.1 Introduction

This chapter presents the study results. Descriptive data and the results of correlational and multiple regression analyses are reported. First, the chapter summarises the demographic characteristics of the sample and descriptive statistics, which contextualise the data interpretation. This is followed by findings from the Pearson correlation analysis and concludes with the stepwise regression analysis.

4.2 Demographic Characteristics

As described in Chapter 3, the sample comprised 135 participants. The participants' demographic characteristics included gender, age, home language, and the study phase. The gender distribution of the sample was in favour of females, with 87% comprising females and 13% males. The mean age of the sample was 20.3 (SD=1.8), with the minimum age of participants being 17 and the maximum being 25. Most participants were undergraduate students, forming 82% of the sample.

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Table 1 provides a more detailed account of the sample's demographic characteristics.

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Table 1

Demographic Characteristics: Student Sample

Demographic characteristics	Frequency	Percentage
Gender		
Female	117	87
Male	18	13
Home language		
Afrikaans	44	33
English	61	45
African	28	20
Other	2	2
Study phase		
Undergraduate	111	82
Postgraduate	24	18

N=135

4.3 Descriptive Statistics

The mean, standard deviation, minimum, and maximum values for BDI-II, TCI-R and PR6 are indicated in Table 2, Table 3, and Table 4, respectively.

Table 2

Descriptive Statistics for the Beck Depression Inventory-II

	Mean	SD	Minimum	Maximum
BDI-II	15.7	9.9	0	41

N = 135; Beck Depression Inventory-II

Table 2 reflects the mean score for the BDI-II as 15.7 (SD = 9.9). According to Beck et al. (1996), scores on the BDI-II that range from 14 to 19 are categorised as mildly depressed. Following the categories as proposed by Beck et al. (1996), this student sample can be categorised as displaying mild depressive symptomology. The BDI-II is considered to be a self-report measure and can be prone to response bias (Beck et al., 1996) as individuals may exaggerate symptoms or answer in a manner that is believed to be socially desirable and hence respond in untruthful manner. Therefore, scores may be higher or minimised when the BDI-II is administered.

Table 3

Descriptive Statistics for the Temperament and Character Inventory-Revised

TCI-R-subcales	Mean	SD	Minimum	Maximum
Novelty seeking	2.8	.5	1.85	4.15
Harm avoidance	3.1	.7	1.20	4.85
Reward dependence	3.3	.6	1.30	4.65

TCI-R-subcales	Mean	SD	Minimum	Maximum
Persistence	3.6	.6	2.15	5.00
Self-directedness	3.4	.7	1.49	4.81
Cooperativeness	4.1	.5	2.65	4.95
Self-transcendence	3.2	.7	1.19	4.54

Note. N = 135; TCI-R = Temperament and Character Inventory-Revised

Table 3 indicates the TCI-R mean scores for the temperament and character dimensions. Applying the TCI-R Likert scale cut-off levels, with a 5-point scale ranging from 1 (definitively false) to 5 (definitively true) as proposed by Cloninger (1999), this group displayed high CO, PS, and SD, followed by average traits of RD and HA and low NS.

Table 4

Descriptive Statistics for the Predictive 6-Factor Resilience Scale

PR6 subscales	Mean	SD	Minimum	Maximum
Tenacity	7.6	2.1	2	10
Vision	6.8	1.9	2	10
Collaboration	5.7	1.9	2	10
Composure	5.7	2.2	2	10
Reasoning	6.5	1.9	2	10
Momentum	6.6	2.0	2	10
Health	6.0	1.7	2.0	10.0
Total resilience	0.6	0.1	0.29	0.97

Note. N=135 PR6 = *Predictive 6-Factor Resilience Scale*

According to Rossouw and Rossouw (2016), a total resilience score can be computed as an average of each of the six subscales, ranging from 1 (highest resilience) to 0 (lowest resilience)). Table 4 shows the mean score for total resilience of this sample as 0.6 (SD= 0.1). Provided the scoring guidelines proposed by Rossouw and Rossouw (2016), the students in this study displayed an elevated level of resilience. From all the measured resilience domains, students reported prominent levels of hardiness and perseverance (tenacity), followed by goal-oriented behaviour and self-efficacious decision-making (vision).

4.4 Reliability

An assessment measure's reliability refers to the consistency, stability, and predictability of results produced by the instrument when measuring the same construct (Foxcroft & Roodt, 2018).

4.4.1 Internal Consistency

Internal consistency is frequently used to assess the reliability of psycho-measuring instruments. This method inspects how much each question or statement in a scale links with the others on that scale, such as the instrument or scale determining what it should measure (Foxcroft & Roodt, 2018). Cronbach's alpha investigated the study's internal consistency. The following reliability coefficients were found: (TCI-R) $\alpha = .79$; (BDI-II) $\alpha = .90$; (PR6) $\alpha = .80$. These results indicate good to excellent internal consistency for the instruments used in this study.

4.5 Correlation Analysis

A visual analysis of the scatterplots and the skewness/kurtosis range was conducted; score distribution was deemed within the range for a Pearson's correlation analysis. This analysis investigated the relationships among the study variables. As a statistical method, it

measures the linear correlation between two sets of data (Chatterjee & Hadi, 2012). Table 5 shows the correlations between depression and temperament, character, and resilience.

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Table 5

Correlations Between Depression and Temperament, Character, and Resilience

		BDI-II	<i>p</i>
TCI-R			
Temperament	Novelty seeking	.08	.386
	Harm avoidance	.63**	<.001
	Reward dependence	-.11	.216
	Persistence	-.32**	<.001
Character	Self-directedness	-.71**	<.001
	Cooperativeness	-.28**	<.001
	Self-transcendence	-.16	.071
PR6			
Resilience	Tenacity	-.57**	<.001
	Vision	-.34**	<.001
	Collaboration	-.31**	<.001
	Composure	-.47**	<.001
	Reasoning	-.46**	<.001
	Momentum	-.57**	<.001

	BDI-II	<i>p</i>
Health	-.27**	<.001
Total resilience	-.65**	<.001

N=135; BDI-II= Beck Depression Inventory-II, PR6 = Predictive 6-Factor Resilience Scale, TCI-R = Temperament and Character Inventory-Revised.

** . $p < .01$ (2-tailed),

4.5.1 Depression Symptomatology and Temperament Traits

Significant correlations were established between depressive symptomatology and temperament traits of the TCI-R. The Pearson correlation analysis indicated a significant positive correlation between depression and HA, $r(133) = .63, p < .001$. Participants with higher levels of HA, therefore, reported more depression symptoms than those with lower HA. A significant negative correlation between depression and PS, $r(133) = -.32, p < .001$, was revealed. A negative yet significant relationship indicates that depressive symptomatology increased as PS decreased.

4.5.2 Depression Symptomatology and Character

Character aspects, such as CO and SD, have a significant negative relationship with depression. Cooperativeness has a significant negative correlation between depression, $r(133) = -.28, p = .001$. This character dimension can be observed as a person's ability to accept and identify with others (Bajraktarov et al., 2017). A significant negative relationship infers that those with high facilitative relationships report lower levels of depressive symptomatology. The study established that SD has a significant negative relationship with depression, $r(133) = -.71, p < .001$. Results indicate that depressive symptomatology decreases as SD increases.

4.5.3 *Depression Symptomatology and Resilience Factors*

Pearson's correlation analysis revealed that all the PR6 resilience subscales negatively correlated with the BDI-II. The following subscales of resilience have the highest correlation. A significant negative correlation between depressive symptomatology and tenacity was established: $r(133) = -.57, p < .001$, followed by the Momentum domain of resilience $r(133) = -.57, p < .001$. The latter shows that as approach behaviours increase, depressive symptom presentation decrease. Total resilience negatively correlated with depression, $r(133) = -.65, p < .001$, indicating a significant association with depression; participants with higher levels of total resilience reported less depressive symptomatology.

4.6 Stepwise Regression Analyses

Stepwise regression analysis using a forward selection technique was computed to accommodate the multiple predictors and build through an iterative process, the optimal predictive model. Considering the exploratory nature of this study, stepwise regression was used. The researcher acknowledges the limitations of this analysis, particularly the sensitivity to sample variations. Prior to the analysis, stringent processes of model validity assumptions such as multicollinearity and outliers were applied and checked using case diagnostics, standardised residual estimates, the Mahalanobis distance, Cook's distance, and average leverage estimates (Thrane, 2019).

Thorough review of the bivariate correlations between the independent variables, the tolerance statistics, and the VIF estimates indicated that multicollinearity assumptions were maintained. Case outliers in the data were identified by Cook's distance of greater than 1 and a standardised residual estimate of greater than 2. The removal of outliers resulted in data analysis from a sample of 110 participants. Following this process, residuals were checked again, and established to be within range. Visual observation of the scatter plot indicated constant residuals (Appendix B: Scatter Plot Analysis for Regression Analysis 1: Depression, Temperament, Character, and PR6 resilience domains). Assumptions for the stepwise

regression analyses were, therefore, met regarding linear relationships, independence, homoscedasticity, and normality (Chatterjee & Hadi, 2012).

Two regression analysis processes were completed. The first included the resilience domains without the total resilience score. The second analysis included only the total resilience and the temperament and character scores. Due to the total resilience score computation based on the composite of all the resilience domain scores, a separate analysis was necessary owing to the high correlation between total resilience score and resilience domain scores.

4.6.1 Regression Analysis 1: Depression, Temperament, Character, and PR6 Resilience Domains

Five models were generated, following an iterative analysis process, of which Model 5 was an overall significant predictor of depressive symptomatology, $R^2 = .73$, ($F(5,104) = 57.19$, $p < .001$), 95% CI [-1.85, 19.91].

Table 6
Step Wise Regression Model Summary

Model	R^2	Adjusted R^2	R^2 Change	F Change
1	.49	.48	.48	101.74
2	.61	.60	.12	34.04
3	.67	.66	.06	18.02
4	.71	.70	.04	14.77
5	.73	.72	.03	10.15

N =110; Dependent variable- BDI-II

Model 5 included these independent variables; HA (temperament trait), NS (temperament trait), tenacity (resilience factor), momentum (resilience factor) and collaboration (resilience factor). The five independent variables in Model 5 accounted for 73% of the variance on the BDI-II.

Table 7 includes the regression coefficients for Model 5, from which deductions can be made to describe the predictor variables of depression

Table 7

Regression Coefficients: Depression, Temperament Traits, and PR6 Resilience Domains

Model		<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>
1	(Constant)	-9.32	2.39	-	-3.90	<.001
	Harm avoidance	7.64	.76	.70	10.09	<.001
2	(Constant)	12.01	4.21	-	2.85	.005
	Harm avoidance	4.81	.82	.44	5.86	<.001
	Tenacity	-1.64	.28	-.44	-5.83	<.001
3	(Constant)	-3.79	5.40	-	-.70	.484
	Harm avoidance	5.58	.78	.51	7.17	<.001
	Tenacity	-1.51	.26	-.40	-5.76	<.001
	Novelty seeking	4.45	1.05	.25	4.25	<.001
4	(Constant)	4.84	5.55	-	.87	.386

Model	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>
Harm avoidance	4.64	.78	.42	5.98	<.001
Tenacity	-1.15	.27	-.31	-4.34	<.001
Novelty seeking	4.01	.99	.22	4.04	<.001
Momentum	-1.09	.29	-.26	-3.84	<.001
5 (Constant)	9.03	5.49	-	1.65	.103
Harm avoidance	4.25	.76	.39	5.63	<.001
Tenacity	-1.09	.25	-.29	-4.27	<.001
Novelty seeking	4.29	.96	.24	4.49	<.001
Momentum	-1.10	.27	-.26	-4.01	<.001
Collaboration	-.73	.23	-.17	-3.19	.002

N = 110

All the independent variables in Model 5 are significant predictors, at $p < .001$, with collaboration a significant predictor, at $p = .002$. The regression model further shows that the temperament trait of HA is the optimal predictor of depressive symptomatology, explaining 39% of the variance, followed by the resilience domain of tenacity (29% of the variance) and momentum (26% of the variance), temperament trait of NS (24% of the variance) and resilience domain of collaboration (17% of the variance). Temperament traits indicated positive beta coefficients, with resilience characteristics indicating negative ones. None of the character dimensions were significant predictors of depressive symptomatology.

As indicated in Table 8, of the dispositional temperament traits, higher HA and NS predicted higher depressive symptomatology. Participants with higher resilience characteristics of tenacity, momentum, and collaboration were more inclined to present lower reported depressive symptomatology. Combined, individuals with hardiness and perseverance, openness to confronting difficulties/approach behaviours, and healthy social attachments are less inclined to present severe depression.

4.6.2 Regression Analysis 2: Depression, Temperament, Character, and Total Resilience

A second regression analysis was computed with the total variable resilience. As this overall score is a composite of the resilience domain scores, a regression, including the total resilience score and domain scores, was not considered statistically viable. Observing the bivariate correlations between the independent variables, the tolerance statistics, and the VIF estimates indicate that multicollinearity assumptions were maintained. Case outliers in the data were identified by Cook's distance of greater than 1 and a standardised residual estimate of greater than 2. The removal of outliers resulted in data analysis from a sample of 120 participants. Following this process, residuals were checked again, and established to be within range. Visual observation of the scatter plot indicated residuals to be constant (Appendix C: Scatter Plot Analysis for Regression Analysis 2: Depression, Temperament, Character, and Total Resilience); therefore, assumptions for the stepwise regression analyses were met regarding linear relationships, independence, homoscedasticity, and normality (Chatterjee & Hadi, 2012). Following the iterative process, this computation yielded three models.

Table 8

Step Wise Regression Model Summary

Model	R^2	Adjusted R^2	R^2 Change	F Change
1	.63	.63	.63	186.45
2	.66	.65	.03	10.20
3	.72	.71	.06	21.66

N = 112

Model 3 accounted for 72% of the depression variance scores, $R^2 = .72$, $F(3,108) = 91.38$, $p < .001$, CI [-.17, 25.95]. The model included these independent variables: HA (temperament trait), NS (temperament trait) and total resilience.

Table 9 includes regression coefficients for Model 3, from which deductions can be made to describe the relationship between the predictor variables and depression scores.

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Table 9

Regression Coefficients: Depression, Temperament, Character, and Total Resilience

	Model	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>
1	(Constant)	48.25	2.53	-	19.09	<.001
	Total resilience	- 52.43	3.84	-.79	-13.65	<.001
2	(Constant)	38.94	3.79	-	10.27	<.001
	Total resilience	- 52.38	3.69	-.79	-14.20	<.001
	Novelty seeking	3.30	1.03	.18	3.19	<.002

	Model	<i>B</i>	<i>SE</i>	β	<i>t</i>	<i>p</i>
3	(Constant)	12.89	6.59	-	1.96	.053
	Total resilience	-36.54	4.80	-.55	-7.61	<.001
	Novelty seeking	4.62	.99	.25	4.67	<.001
	Harm avoidance	3.92	.84	.35	4.65	<.001

N = 112

As indicated in Model 3, the optimal depression predictor scores were total resilience, which accounted for 55% of the depression variance scores, followed by the temperament traits of HA (35% of the variance) and NS (25% of the variance). The results show that students with high-risk factors (dispositional temperament traits) may be susceptible to clinical depression; however, overall resilience comprising dynamic facets, such as tenacity, momentum, and collaboration may provide a protective buffer mediating the transition from prodromal depressive symptoms to clinical manifestation.

4.7 Conclusion

The above section outlines the demographic characteristics of the student sample, descriptive statistics for temperament, character, and resilience, Pearson correlations and the regression analyses indicating significant predictors of depressive symptomology. The following Chapter 5 provides an integrative interpretation and discussion of the results concerning the relevant literature.

Chapter 5: Discussion

5.1 Introduction

Depression is a highly prevalent mental disorders among students, often associated with functional, cognitive, and social consequences (Farrer et al., 2016; Ibrahim et al., 2013; Mungai & Bayat, 2019; Sarokhani et al., 2013). A complex relationship exists between affective disorders and personality, due to some personality features that predispose a person to symptoms of a depression (Peirson & Heuchert, 2001). According to Cloninger (1993), personality traits comprised of temperament and character traits have been shown to be predictive factors for depressive symptoms (Naito et al., 2000; Peirson & Heuchert, 2001). Character traits have been reported to play a protective role in student mental health and is a prediction of higher general well-being levels (Stormon et al., 2022). Research also indicated that resilience might have a protective role in depression onset together with specific state-related character strengths (Loh et al., 2014; Zhang et al., 2020)..

Overall, the study aimed to explore the relationships between depression and temperament, character, and resilience among university students. Moreover, the study intended to further determine if trait-related and state-related dimensions were predictors of depression. The findings of the correlational analysis and the multiple regression analyses are discussed and contextualised within the relevant research literature. The chapter highlights the strengths and limitations of this study and outlines recommendations for future research.

5.2 Depression Among University Students

This study utilised the Beck Depression Inventory-II (BDI-II) to identify depressive symptomatology among students (Beck et al., 1996). Makhubela and Mashegoane (2016) established that the BDI-II yields reliable, internally consistent, and valid scores for South African university students. The results of the current study established that the students' sample mean scores on the BDI-II was 15.7 (SD= 9.9). This indicated a mild depression level, according to BDI-II interpretation guidelines (Beck et al., 1996). The average age for this student sample was 20.3 (SD= 1.7), with 82% at an undergraduate level. According to Kessler

et al. (2007), students are usually within this age range (18 to 24); and this is a sensitive life phase where mood disorders might manifest (Balon et al., 2015; Kessler et al., 2007).

As illustrated in earlier chapters, depression is a complex mental disorder that may lead to dysfunction in interpersonal, social, and occupational day-to-day tasks. The current study results corroborate research conducted within the South African and international contexts (Farrer et al., 2016; Mungai & Bayat, 2019; Pillay et al., 2020). For example, a national survey established that the pervasiveness of depression increased from 22.31% in 2010 to 26.05% in 2015 (Mungai & Bayat, 2019). Van Zyl et al. (2017) established that 26.5% of medical students experienced moderate to severe depression on the depression anxiety and stress scales. A systematic review of 24 studies established that depression among students ranged between 10% to 85% (Ibrahim et al., 2013). Van Zyl et al. (2017) further established that the frequency of depression increased among students who used alcohol in order to cope with challenges. These patterns of delayed access, initiation of treatment, and maladjusted coping strategies among students advocate for introducing programmes focused on enhancing resilience and coping mechanisms (van Zyl et al., 2017).

According to the neurobiological framework, depression has neurological underlying aetiology and pathophysiology (Kupfer et al., 2016; Russo et al., 2012). Previous research pursued a neuro-scientific enquiry into understanding the aetiology and pathophysiological factors contributing to depressive symptoms, development, and progression (Koenigs et al., 2008; Kupfer et al., 2016; Mayberg, 1997). These research studies produced insights into multiple explanations, linking depression to neurotransmitter systems and functional and structural brain anatomy (Klein et al., 2011; Kupfer et al., 2016). Neurogenesis and neuron production are emphasised when considering the aetiology of depression (Jacobs, 2002; Jacobs et al., 2000; Kaltenboeck & Harmer, 2018), with specific reference to the gyrus of the hippocampal formation.

Suggestions were made that stress decreases neurogenesis, which could relate to individuals experiencing prolonged stress; therefore, they may experience prolonged depressive symptomatology (De Kloet et al., 2005; Kaltenboeck & Harmer, 2018). Studies focused on how depressive symptomatology impacted predominant mechanisms controlled by

the prefrontal cortex (Goldstein et al., 2014). These mechanisms remain imperative as they regulate the neural processes that enable focused and determined behaviour, such as future planning, gauging risks, and altering ineffective behaviour patterns (Kaltenboeck & Harmer, 2018).

Improving the understanding of the neuroscientific basis of depression aids in advancing clinical research and promoting integrated depression treatment (Kaltenboeck & Harmer, 2018). The study results established a prevalence pattern indicating mild depression within this student cohort. The outcomes follow the prevalence patterns reported within the South African university context and international universities.

5.3 Temperament and Depressive Symptomatology

5.3.1 Associations Between Temperament and Depressive Symptomatology

Temperament is heritable and a trait related to a neurobiological difference in behavioural conditioning (Cloninger et al., 1993; Garcia, Cloninger, et al., 2020; Hansenne et al., 1999). Temperament domains do not manifest as linear but rather as non-linear dynamic domains that moderate human psychological functions and personality development. This student cohort displayed elevated PS, average traits of RD and HA, and low NS. The sample of this study displayed mild depressive symptomatology or a ‘prodromal’ stage—not a more severe clinical depression disorder. The correlational analysis indicated a significant positive association between HA and depression and a significant negative association between PS and depression.

5.3.1.1 Harm Avoidance.

Harm avoidance is one of the four temperament dimensions (i.e., NS, HA, RD, and PS) of Cloninger’s (1994) biopsychosocial personality model. HA is a person’s tendency to respond intensely to signs of unpleasant experiences and behaviours characterised by restraint; therefore, individuals with high HA can be pessimistic, apprehensive, shy, and prone to fatigue

(Cloninger et al., 1994). Conversely, individuals with low HA are carefree, relaxed, courageous, optimistic, and composed (van Berkel, 2009).

As a temperament trait, HA can also be characterised as excessive worrying and being fearful and doubtful, and suggest low serotonergic activity (Chen et al., 2015). The research investigated the association between HA and elements of the serotonin system, such as the genetic variation in 5-HTTLPR in the serotonin transporter gene (Chen et al., 2015). This gene plays a role in precipitating depression during a stressful situation (Pezawas et al., 2005). Serotonin in the brain regulates anxiety and mood conditions. For example, low neurotransmitter levels were associated with depression, and increased serotonin levels brought on by medication decrease arousal and, therefore, reduce anxiety and regulate mood (Moret & Briley, 2011).

This study identified a significant positive association between depression and HA. Participants of this study with higher levels of HA reported increased depressive symptoms compared to those with lower HA. These results can be corroborated by earlier research on medical students in Taiwan (Chen et al., 2015; Chen et al., 2018). The authors established that the levels of both depressions increased (6.4 scores for BDI) during the internship as HA scores were significantly correlated with depression (Chen et al., 2018).

5.3.1.2 Persistence

Persistence is a temperament dimension reflecting a person's PS level in their intentional behaviours and actions. The present student cohort displayed elevated levels of PS, indicating a profile of diligent, determined, and ambitious students. According to Stormon et al. (2022), students with personalities high in PS demonstrate prominent levels of general well-being due to their ability to persevere despite adversity, frustration, or fatigue. The students within this study displayed elevated levels of PS, possibly accounting for mild depression levels. The significant negative association between PS and depression indicated that students with high levels of PS reported lower levels of depression than their peers with lower levels of PS.

5.3.2 *Temperament as a Predictor of Depression*

Multiple regression analyses incorporating resilience domains, character, and temperament identified the HA temperament trait as an optimal predictor of depressive symptomatology, explaining 39% of the variance; the temperament trait of NS explains 24% of the variance. The temperament traits of RD and PS were not indicated as depression predictors in this cohort. The results of the current study corroborate the findings of previous research (Bajraktarov et al., 2017), identifying HA as a depressive disorder predictor. Students displaying higher levels of HA were more inclined to suicide ideation; therefore, it served as predictors for depressive episode development. A study identifying temperament traits influencing suicide risk when students are depressed established that elevated NS levels increased the risk (Lee et al., 2017).

A longitudinal study on Chinese university students substantiated significantly higher NS before the COVID-19 lockdown; these correlated with lower levels of depression (Li et al., 2020). This study further established that decreases in depression during the pandemic might be attributable to increases in the NS dimension (Li et al., 2020). Research corroborates and, conversely, contradicts the study findings.

The multiple regression model incorporating total resilience revealed the following temperament predictors: HA (35% of the variance) and NS (25% of the variance). Both models justify neurobiological dispositional temperament traits as depressive symptomatology predictors. This supports the link between the neurobiological theories of depression. For example, higher scores on HA can reflect decreased serotonergic activity and serotonin modulates mood, behaviour, and cognition (Hansenne et al., 1999). NS has a more complex relationship with depression outcomes; however, Stormon et al. (2022) established that when HA and NS were higher, the students in this group had an increased depression risk compared to students with lower HA and NS combination of traits.

A finding in this study signified that the bidirectional correlation implied that PS—and not NS—significantly relates to depression; however, when a regression model was run, including resilience and character, NS and not PS was a significant predictor. Considering the TCI-R trait of PS, the overlap between PS and dimensions of resilience, such as tenacity as

measured by the PR6, may account for PS as a nonsignificant depression predictor in this model. Varied results may be established from other age groups with a more severe depression profile, as this cohort had high PS and reported mild depression.

5.4 Character and Depressive Symptomatology

5.4.1 Associations Between Character and Depressive Symptomatology

The study sample displayed high CO, SD, and ST. These character profiles denote how people relate to others and themselves. According to Cloninger (1993), it demonstrates differences based on what individuals have learnt and experienced. Social learning and life events influence character traits. Certain character traits may change; character traits reflect neurobiological and sociocultural mechanisms of learning that takes place over one's lifespan, with self-awareness playing an integral part of this ability to learn.

The current study revealed that character aspects significantly negatively correlate with depression. Students with higher CO, ST, and SD reported lower depression scores than their peers, reporting lower character attributes. Research revealed that low SD levels are associated with susceptibility to depression (Bajraktarov et al., 2017; Mochcovitch et al., 2012). Research on dentistry students indicated that those with high SD levels demonstrated increased feelings general well-being (Stormon et al., 2022); this may function as a buffer against depression. The character profile of Japanese students with low SD and CO are contributory predictors for the novel development of depressive episodes (Takanobu et al., 2021).

A longitudinal study of the general population determined that, with high SD, ST were positively correlated with elevated prevalence of depressive symptoms. This may elucidate why some researchers identify a positive correlation between ST and depression (Celikel et al., 2009; Hansenne et al., 1999; Hirano et al., 2002), whereas others did not demonstrate an association (Farmer et al., 2003; Nery et al., 2009). The interplay between levels of temperament and character are crucial environmental drivers of clinical manifestations, such as depression; this is based on the psychobiological framework and underlying neurotransmitter systems.

Contrary to research on character profiles and their relationship with depression (Bajraktarov et al., 2017; Takanobu et al., 2021), the current study revealed that character traits were not depression predictors when resilience and temperament were included in the model. Character and ST and depression research in students is limited; studies focus on general populations and clinically depressed patients.

According to the literature, temperament and character traits are depression predictors (Bajraktarov et al., 2017; Cloninger et al., 2006; Hansenne et al., 1999). In the current study, the results for temperament concurred with their observation; however, for character, the results were contradictory. An overlap exists between the state-related resilience variable (e.g., collaboration domain) and the character dimension of CO. Collaboration encompasses psychosocial engagements such as positive and secure attachments within environments, different contexts, and support systems (Rossouw & Rossouw, 2016). Similarly, CO includes interactions with others, measuring how well they can be in harmony, including the level of helpfulness, empathy, and social principles (Cloninger, 2008).

Collaboration was a significant depression predictor in the regression analysis. This dimension on the PR6 may better capture the underlying state-related attribute; therefore, this result may be a methodological artefact of the instruments used. The sample age of the student group within this study may also contribute to this nonsignificant result, as SD and CO are reported to strongly correlate with age (Hansenne et al., 1999). This study did not account for age as a variable; however, the results could be explained by a small student cohort comprising young adults within a limited age range. In this small study cohort, character attributes may also be less robust as predictors compared to similar resilience facets, particularly in mild or prodromal depression.

5.5 Resilience and Depressive Symptomatology

5.5.1 Associations Between Resilience and Depressive Symptomatology

Rossouw and Rossouw (2016) suggest that tenacity as a resilience facet refers to decisively knowing how to proceed. Tenacity relies on a conscious decision under the

individual's preferred path. From a neurobiological perspective, Keller et al. (2012) identified the PFC's importance in the downregulation of HPA activation which can then be used to maintain goal directed behaviour and aid in the conquering challenges and adversity. The PFC is vital to regulate limbic effectively and HPA activation (Keller et al., 2012). These neural networks are integral to affective regulation and anxiety conditions. Southwick and Charney (2012) emphasise this as a resilience facet intervention that could focus on enhancing student coping strategies. This includes presenting them with therapeutic devices, such as breathing exercises or mindfulness training to downregulate HPA activation and may prevent depression from progressing to clinically diagnosed depression. Rossouw and Rossouw's (2016) neurobiological model of resilience focuses on the potential bidirectional relationship between resilience and health. Research specified that understanding resilience as intrinsic or trait-related was substituted by being a dynamic and multidimensional state (Martin & Marsh, 2006; Rossouw & Rossouw, 2016). The current study revealed significant negative correlations for all seven resilience and total resilience domains, including depressive symptomatology; tenacity, vision, collaboration, composure, reasoning, momentum, health, and overall resilience increased, whereas depressive symptomatology decreased. Concerning the aforementioned domains, tenacity, momentum, and composure denoted the highest correlations with depression, followed by reasoning, vision, collaboration, and health.

According to research, resilience mediates the severity of psychiatric onset; students with a high level of resilience reported low depression levels (Southwick & Charney, 2012). Research on resilience indicated that it served as a safeguard for the public during COVID-19, as psychological resilience and an active coping style is a protective factors against depression (Song et al., 2021). Rossouw and Rossouw (2016) suggest that tenacity as a resilience facet refers to decisively knowing how to proceed. Tenacity relies on a conscious decision under the individual's preferred path.

From a neurobiological perspective, the PFC is vital to regulate limbic systems effectively and HPA activation (Keller et al., 2012). These neural networks are integral to affective regulation and anxiety conditions. Southwick and Charney (2012) emphasise this as a resilience facet intervention that could focus on enhancing student coping strategies. This includes presenting them with therapeutic tools, such as breathing exercises or mindfulness

training to downregulate HPA activation and help safeguard against the progression of depressive symptomatology.

5.5.2 Resilience as a Predictor of Depression

Resilience functions as a psychological buffer and protective role against depression. Studies corroborated resilience as a protective factor (Cassidy, 2015; Loh et al., 2014; Zhang et al., 2020). The current study hypothesised resilience domains significantly predict depression outcomes. The multiple regression analyses identified the following resilience factors as significant depression predictors: tenacity, momentum, and collaboration. The inclusion of overall resilience in the model displayed the optimal depression predictor outcomes, followed by HA and NS. These results suggest that the interplay between trait and state-based psychological attributes may support depression outcomes, such as dispositional temperament and resilience.

Dopaminergic neurons from the ventral tegmentum are key neurotransmitters when persisting through challenges and adversity as they help an individual maintain a level of motivation (Keller et al., 2012; Rossouw et al., 2017a); therefore, this infers that although university students are experiencing stressful events, skills can be taught to help students behave in a manner that is goal focused. This can regulate their stress response by downregulating HPA activation as this can serve as a buffer in the development of depression symptomatology.

Rossouw and Rossouw (2016) suggest that momentum predicts goal achievement by considering an individual's approach and avoidance of motivational schemas. Diverse neural networks cause approach and avoidance schemata developed to protect and satisfy basic needs. Deficits in approach and avoidance motivation schemata can contribute to reduced positive experiences; it may reinforce depressed behaviour, contributing to the onset and maintenance of depressive symptomatology (Trew, 2011).

Avoidance schemas enlighten information processing biases and can, therefore, increase vulnerability to depression onset and recurrence (Trew, 2011). According to Owen

(2012), resilience relates to executive functions, such as problem-solving and flexible thinking during adversity. Students' evaluation of their stressful university context and their problem-solving ability can, therefore, contribute to differentiation in depressive symptomatology (Kaczmarek, 2009; Owen, 2012). Collaboration pertains to secure attachment and psychosocial integration. Neurobiologically—the right prefrontal cortex (RPFC)—receives cues critical to secure attachment. A neurobiological resilience framework allows for focus on enhancing specific resilience-related skills. Based on shared neurobiology with depression and temperament, this may inform short-term intervention programmes for students with subclinical depression symptoms entering student counselling centres for support.

Resilience research promotes coping mechanism development among high-risk individuals (Cassidy, 2015; Masten et al., 1990). Health promotion programmes aiming at reinforcing psychological resilience for undergraduate medical students may assist in fostering positive coping styles relating to prefrontal cortex functioning (Wu et al., 2020). Positive coping styles equip students with increased positive behaviours; this resilience facet of momentum may enhance serotonergic metabolism and help them cope with stressful and adverse experiences (Wu et al., 2020). Social support networks are positive coping mechanisms and is part of the collaboration resilience domain, cooperating with support networks and teams.

Resilience-based intentions incorporating the collaboration domain may include support networks for students. Enhanced collaboration is associated with increased dopamine, which can underlie the ability to hold a positive appraisal during a stressful situation (Southwick & Charney, 2012). The positive appraisal of challenging and stressful circumstances affects a person's problem-solving ability (linked to prefrontal activation) while altering negative thought patterns and ruminations (Chmitorz et al., 2018; Rossouw & Rossouw, 2016; Shaw et al., 2016).

The aforementioned encapsulates resilience factors' impact on depressive symptomatology. The earlier the resilience interventions for mild psychological distress, the more likely an alleviation of depressive symptomatology. The study results emphasise an essential neuroscience perspective from which the reader can understand the impact of

resilience on depression and mental health. The neurobiological temperament dispositions also hold a function in presenting depressive symptomatology. A multifaceted approach incorporating the neurobiological understanding of resilience and temperament can help to develop novel short-term intervention strategies, which may safeguard students from the escalation of prodromal depression. Mitigating the transition from mild to severe depression may alleviate the demands placed on these centres, considering resource-limited student centres.

5.6 Practical and Clinical Applications: Intervention and Prevention

The interplay findings between dispositional traits, character, and neurobiological resilience could promote the development of focused interventions to treat prodromal depression among students. Literature increasingly emphasises the expanding prevalence and severity of mental health challenges of university students (Naidoo & Cartwright, 2018; Pillay et al., 2002; Van Breda, 2017). Further research implies that the main challenge for student support counselling services is that they are overburdened and under-resourced, while facing the exponential increase in university students requiring mental health services (Amponsah et al., 2021; Naidoo & Cartwright, 2020).

As young adults, university students commonly experience academic pressure, new social transitions, anxiety, and depressive symptomatology (Kumaraswamy, 2013). In a South African context, students' mental health can be further influenced due to the unique socio-political and socio-economic factors in the country (Gibbs et al., 2018; Pillay et al., 2002). These factors may include financial difficulties due to the economic disparities within the population, cultural alienation, and unreadiness for university standards and academic expectations (Walt et al., 2020). Neurobiological evidence-based interventions may provide novel short-term support to students at risk.

Research has been conducted on the topic of the protective nature of resilience in mental health and specifically depression (Chmitorz et al., 2018; Masten et al., 1990; Shaw et al., 2016). Resilience is a psychosocial skill that can be built periodically over time and promoted

through specific therapeutic interventions (Southwick & Charney, 2012). For instance, interventions focusing on mindfulness as neural circuit training help with emotional regulation by engaging the certain neurobiological structures such as the brainstem systems and the prefrontal cortex limbic systems (Southwick & Charney, 2012). Concerning the significant relationship between tenacity and depression, university student counselling divisions could channel their efforts to host resilience-enhancing interventions, such as focus sessions on goal and achievements as well as focus on key study skills such as time management and planning. Such workshops may equip students with the skills to embody equanimity and enhance adaptability and recovery when encountering adversity and challenges within the university context.

Such interventions may cultivate a growth mindset in students while encouraging goals, promoting challenge-seeking, and fostering the skills enabling students to pursue these goals tenaciously (Dweck et al., 2014). Combining depression treatment of mild depressive symptomatology with the understanding of how dispositional temperament traits and character relate to depression will lead to a more holistic and robust intervention based on the principles of evolving neuroscience and the understanding of psychiatric disorders and state-based psychological attributes.

The COVID-19 pandemic and government restrictions affected mental health services as they have now been virtual; these factors must be considered when implementing such programmes or services (Amponsah et al., 2021; Naidoo & Cartwright, 2020). To illustrate, group intervention that can be held online may assist students in nurturing resilience skills to ensure healthier mental health trends. Group interventions may include the resilience domain of collaboration as it centres on social support networks and psychosocial interactions. The perceived support within group interventions reinforces the value of beneficial neural activation in the prefrontal cortex, regulating stimuli that can cause distress while maintaining wellness by positive perceptions (Rossouw & Rossouw, 2016). For example, it was shown that among students with high HA, short-term cognitive behavioural therapy intervention positively modified students' cognitions, thus highlighting the link between dispositional trait and resilience-based outcome (Saigo et al., 2018).

Incorporating group intervention to focus on the resilience-based motivation schemas and cognitions that underlie high HA may ensure the interventions are timeous, focused, and effective for students. Students with elevated levels of NS may pursue innovative experiences and exercise their capacities to learn from new challenges. Including NS in interventions can help students with self-development; individuals with elevated NS levels can reconstruct new meanings during adversity or challenges (Crescentini et al., 2018; Li et al., 2020). Tasks intentionally including reflection, mindfulness, and meaning may help to reconstruct the meaning of encountering adversity. According to Pirson et al. (2018), NS positively correlates to psychological and subjective well-being.

5.7 Summary

According to this study, dimensions of temperament and character correlate significantly with depressive symptomatology in this student cohort; the results also support literature findings confirming temperament dimensions as predictive factors of depressive symptomatology (Bajraktarov et al., 2017; Hansenne et al., 1999; Takanobu et al., 2021).

Harm avoidance and PS correlate differently to depression; PS reveals a significant negative correlation to depression, whereas HA shows a significant positive relationship to depressive symptomatology. Students with high PS levels may demonstrate elevated levels of general well-being (Stormon et al., 2022), supporting the study's findings. The temperament dimensions, HA and NS were significant depression predictors. Research reported similar finding that supported HA and its predictive function in depressive symptomatology (Chen et al., 2018; Stormon et al., 2022). Research on NS is contradictory, as some findings designate NS as a predictive factor for depression (Lee et al., 2017), whereas other studies assert the opposite (Li et al., 2020).

Character dimensions (SD, ST, and CO) have a significant negative relationship with depression; therefore, students with elevated levels of these character attributes signify lower depressive symptomatology; however, according to the results, character was not a significant predictor of depression.

The university student cohort within this and additional studies, employing various resilience measures, reported high resilience levels (Mittal et al., 2018; Yin, 2011). Resilience has a protective effect on mental health; high resilience levels consistently relate to lower depression levels (Ahmed & Julius, 2015; Hjemdal et al., 2011) and vice versa. This study identified significant predictors in the tenacity domain of resilience, signifying that students' level of perseverance ability and hardiness may decrease stress responses to adversity and, therefore, depression. The momentum domain of resilience indicated that students with direction and purpose had lower levels of depression, relating to psychosocial interaction, including support networks (Rossouw & Rossouw, 2016). Interventions, including peer or student groups, may benefit students with prodromal/subclinical depression.

Finally, although no significant predictors were established in the character dimensions, the literature and findings of the current study confirm the importance of interventions from a neurobiological framework, including multidimensional facets of state-related resilience and character and trait-related temperament.

5.8 Strengths and Limitations of the Study and Recommendations for Future Research

- A strength of the study was in exploring these relationships among students, typically categorised as a non-clinical sample or as a prodromal/subclinical cohort. Understanding the predictors allows for potential insights into factors that may contribute to the transition from prodromal depression to clinical disorder.
- The secondary data were collected through a new resilience measurement instrument the Predictive 6-Factor Resilience Scale (PR6). This instrument was theoretically developed based on a neurobiological perspective (Rossouw & Rossouw, 2016) and included a novel domain of health hygiene (exercise, nutrition, and sleep). This is relevant when investigating depression outcomes, as vegetative symptoms are pathognomonic to affective disorders. Within the original study conducted in 2018, the PR6 was used for the first time in the South African context.

- This study identified neurobiological resilience facets, such as tenacity and momentum, and collaboration with HA and NS temperament traits as significant depressive symptomatology predictors. Resilience conceptualised as a dynamic, multifaceted construct allows for the understanding of specific resilience facets and dispositional temperament traits as potential contributors informing focused interventions at student centres, particularly among individuals with mild features.

The limitations of the study are as follows:

- Data for the original study were collected through an internet-based computerised testing battery; convenience sampling was the sampling technique utilised; therefore, the results cannot be generalised to other populations. A more comprehensive socio-demographic sample and data could have improved the findings' robustness and control for confounding variables. Future research with a larger and more diverse sample representing the university context is recommended.
- This study used secondary data; therefore, the sample from which data was collected was conducted before the COVID-19 pandemic. It does not account for COVID-19 and the influence it may have had on students' mental well-being. Future comparative studies from the neurobiological perspective are recommended to include the COVID-19 context.
- Self-report measures were used in the original study. This could have led to a response bias, where the symptoms may have been under-reported or exaggerated. The possibility exists that participants responded to the self-reported measures in a manner they felt would be socially acceptable.

5.9 Conclusion

The study aimed to determine whether trait-related (temperament) and state-related (character and resilience) psychological attributes are related to depression and whether specific dimensions of temperament, character and facets of resilience predict depression among South African university students. The study revealed that specific temperament traits

(HA and NS) and state-related resilience attributes (tenacity, momentum, collaboration, total resilience) were significant depression predictor outcomes. These results emphasise the interplay between dispositional traits and state-related resilience attributes and depression outcomes.

The study acknowledged the overlap between the neurobiological substrates of temperament, character, and resilience and the psychosomatic and cognitive-affective depression symptoms. These overlaps suggest the value of an integrated approach to the study of prodromal symptoms of depression, temperament, character, and resilience, from a neurobiological perspective. Future research on depressive symptomatology, temperament, character, and resilience among South African university students is recommended. Such research would contribute to the development of effective interventions, acknowledging the neurobiological substrates of dispositional temperament and state-related character, and resilience and their shared neurobiological link with depression.

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Appendices

Appendix A: Letter of Ethical Clearance



Faculty of Humanities
Fakulteit Geesteswetenskappe
Lefapha la Bomotheo



Dear Miss S Naidoo,

Project title: The relationships between depression, temperament, character, and resilience among university students

Researcher: Ms S. Naidoo

Supervisor (s): Prof. N. Cassimjee

Department: Psychology

Reference number: 14088267 (HUM006/1020)

Degree: Masters

Thank you for the application submitted for ethical consideration.

The Research Ethics Committee notes that this is a literature-based study, and no human subjects are involved.

The application was **approved** on 5 November 2020 assuming that the document (s) are in the public domain. Data collection may, therefore, commence along with these guidelines.

Please note that this approval is based on the assumption that the research will be carried out along the lines laid out in the proposal. However, should the actual research depart significantly from the proposed research, a new research proposal and application for ethical clearance will have to be submitted for approval.

We wish you success with the project.

Sincerely,


Prof. Innocent Pikirayi

Deputy Dean: Postgraduate Studies and Research Ethics

Faculty of Humanities

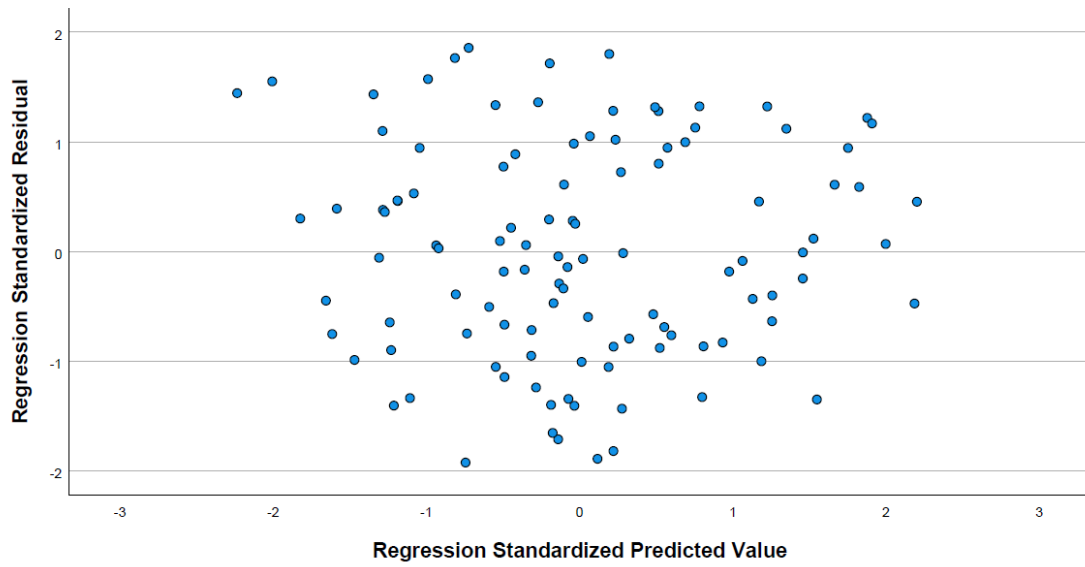
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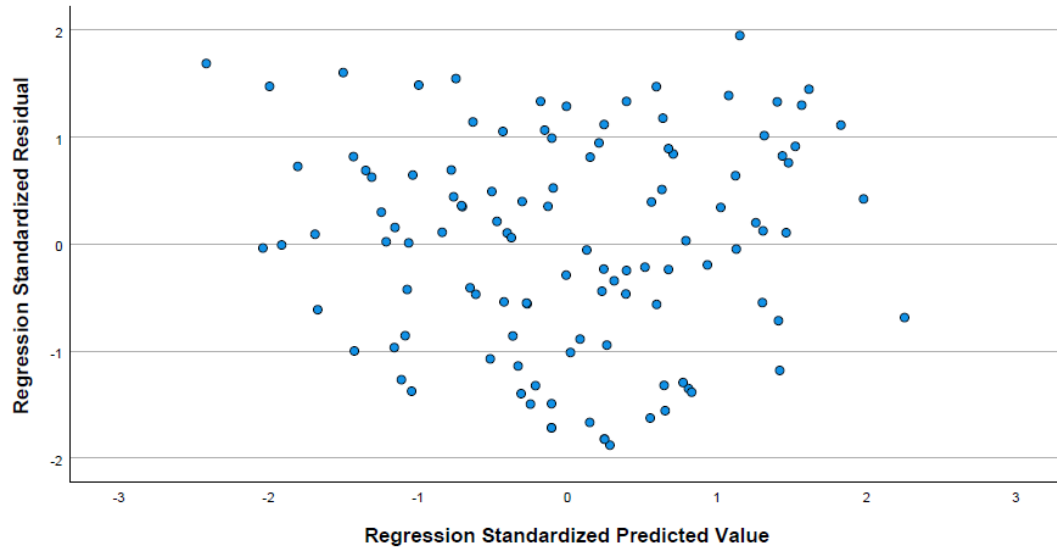
Research Ethics Committee Members: Prof I Pikirayi (Deputy Dean); Prof KL Harris; Mr A Bizo; Dr A-M de Beer; Dr A dos Santos; Ms KT Govinder Andrew; Dr P Gutura; Dr E Johnson; Prof D Maree; Mr A Mohamed; Dr I Noomé; Dr C Puttergill; Prof D Reyburn; Prof M Soer; Prof E Taljard; Prof V Thebe; Ms B Tsebe; Ms D Mokalapa

Appendix B: Scatter Plot Analysis for Regression Analysis 1: Depression, Temperament, Character, and PR6 resilience domains



*Note. N=110

Appendix C: Scatter Plot Analysis for Regression Analysis 2: Depression, Temperament, Character, and Total Resilience



*Note. N=112