EXAMINING THE EFFECTS OF A BIOPSYCHOSOCIAL APPROACH TO PSYCHOLOGICAL WELLBEING IN HIGHER EDUCATION.

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Dedication/Acknowledgements

Whilst my name sits on the title page of this thesis, it is the result of the work, support and endless encouragement from my support network. There are no words that could express how much you have all impacted my life and work!

I would like to thank my supervisors, Professor Mathew Slater and Dr Jamie Gillman. You have supported me every step of this journey. Thank you for your unwavering belief in me, as well as for the countless meetings, encouragement, guidance, and patience throughout. I would also like to thank my colleagues, Dr Anthony Miller, Dr Karla Drew, Dr Andrew Wilkinson, Dr Joe Dixon, and Dr Steph Romano-Smith for their valuable input into my development and for the even more valuable friendship. You have all made my time at Staffordshire University the highlight of my career!

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Lastly, to my husband, who has been by my side from the start and shared this journey with me. You have my love and gratitude for all that you have done. I dedicate this and all achievements to you and our family.

Author's declaration

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I, Tsvetelina Nikolaeva Nenkova, declare that this thesis entitled "Examining the Effects of a Biopsychosocial Approach to Psychological Wellbeing in Higher Education" is the result of my own work and has not been previously submitted for any other degree at Staffordshire University or any other institution. Where any part of this work has been carried out in collaboration with others, this has been clearly indicated, and appropriate credit has been given.

Table of Contents

List of Tables

List of Figures

Abstract

The thesis investigates the integrated impact of psychological, physiological, and social factors on the wellbeing and academic performance of university students. Grounded in the Biopsychosocial Model (BPSM) and the Theory of Challenge and Threat States in Athletes (TCTSA) and its revised form (TCTSA-R), the research explores how students' cognitive appraisals of personal resources, social identity, perceived social support, and irrational beliefs influence their stress responses, wellbeing, and academic outcomes within the higher education context.

The thesis comprises three quantitative empirical studies. The first study uses a large-scale longitudinal survey over an academic year, demonstrating that high self-efficacy, perceived social support, and lower irrational beliefs predict better psychological wellbeing, while different patterns of goal orientations and self-efficacy predict students' self-reported expected academic performance. Findings also reveal a decline in wellbeing and university social identity over time.

The second study integrates psychophysiological measures by assessing cardiovascular indices of challenge and threat responses in close temporal proximity to a graded presentation assessment. While cardiovascular reactions were successfully measured, the expected associations between these physiological markers and psychological resource appraisals, social factors, irrational beliefs, and performance outcomes were weak or non-significant. Nevertheless, self-efficacy remained a consistent predictor of wellbeing and performance expectations, and irrational beliefs predicted emotional experience. These results indicate the complexity of translating physiological stress responses into predictions of academic performance.

The third study evaluates the effects of a coping-oriented personal disclosure mutual sharing (COPDMS) intervention delivered early in the academic year

to facilitate social connection and coping resource enhancement. The intervention did not produce significant group differences in social identification, psychosocial resources, or wellbeing compared to a control group. Notably, participants demonstrated cardiovascular activation indicative of engagement; however, this did not translate into improved wellbeing or positive affect. Qualitative feedback highlighted mixed emotional experiences but generally increased connectedness and empathy among participants.

Overall, the thesis advances knowledge by applying and integrating biopsychosocial theoretical models to the field of higher education, highlighting the pivotal role of self-efficacy and social support in psychological wellbeing, the nuanced role of physiological stress responses, and the challenges of producing immediate wellbeing improvements through brief psychosocial interventions. The research highlights the importance of considering the complex interactions among cognitive appraisals, social identity, and physiological reactivity in supporting student success and wellbeing. The findings inform future theory development and suggest directions for designing scalable, contextually sensitive interventions to enhance student coping and academic performance.

Chapter 1. Literature review

“The ability to read, write, and analyse; the confidence to stand up and demand justice and equality; the qualifications and connections to get your foot in the door and take your seat at the table — all of that starts with education.”

Michelle Obama

1.1. Introduction

The pursuit of higher education (HE) is a transformative journey, offering not only academic achievement but also significant opportunities for personal growth and advancement in life (Turner et al., 2024; Pekrun, 2016). As students navigate their academic paths, they confront a spectrum of challenges associated with transitioning into and out of university life, managing performance pressures, and coping with diverse emotional experiences. These transitions represent critical phases of preparation, adjustment, and stabilisation, during which students seek a sense of belonging and acceptance within their new academic and social environments (Nicholson & West, 1995; Smith & Hopkins, 2005).

Student wellbeing within HE has emerged as a complex, multifaceted concern, intricately linked to academic performance, retention rates, and long-term personal development (Chaudhry et al., 2024; Sosu & Pheunpha, 2019). Understanding student wellbeing through a biopsychosocial lens reveals the significant impact of mental health challenges, including anxiety, depression, and stress, exacerbated by academic demands, the pressure to succeed, and future employment uncertainties (Chaudhry et al., 2024; Li, 2025). Universities have increasingly prioritised student wellbeing through strategic mental health initiatives, a shift towards preventive measures, and the integration of student feedback to develop responsive wellbeing programmes. A holistic approach that encompasses physical, psychological, and social dimensions is essential for fostering resilience, promoting positive mental health, and optimising academic success (Li, 2025).

Given the profound impact of wellbeing on students' academic performance and their development as individuals and professionals, there is a critical need for ongoing research. Understanding the diverse experiences of students is paramount to designing effective support mechanisms that enhance not only their current academic achievements but also their future personal and societal contributions. Investigating these dimensions will provide valuable insights into how to nurture wellbeing, reduce dropout risks, and support students throughout their educational journeys and beyond.

This programme of research is grounded in a holistic biopsychosocial approach to understanding and positively impacting the performance and wellbeing of students in higher education. The current research represents the next steps in a theoretical integration, suggested and supported by physiology, psychology and social research, and its application to the wellbeing and performance of students in higher education. The following sections of this chapter will review the omnipresent phenomenon of stress, which has been the subject of extensive inquiry across philosophical, biological, and psychological domains. This chapter lays the foundational understanding required to appreciate the complexities of stress and appraisal mechanisms, culminating in the exploration of challenge and threat states within an academic context. It provides a comprehensive review of the evolution of stress research, from early philosophical musings to contemporary biopsychosocial frameworks, setting the stage for the empirical investigations presented in subsequent chapters.

The following sections of this chapter begin with an exploration of early developments in stress research, tracing its conceptual roots from Greek philosophy, through Hooke’s law and the mind-body dualism debate, to pivotal contributions by Claude Bernard with his concept of the ‘milieu interne’. The emergence of homeostasis by Walter Cannon and Hans Selye’s formulation of the General Adaptation Syndrome marked significant milestones, establishing the biological underpinnings of stress responses. Following this historical context, the chapter delves into the concepts of arousal and appraisal, examining both physiological and psychological responses to stress. The integration of these responses is further elaborated through the lens of psycho-physiological arousal and the biopsychosocial

model (BPSM) of challenge and threat, highlighting the intricate interplay between biological, psychological, and social factors in stress appraisal. The chapter then transitions to a critical analysis of the Theory of Challenge and Threat States in Athletes (TCTSA), as proposed by Jones and colleagues (2009). This section elucidates key theoretical constructs such as demand and resource appraisals, challenge and threat physiology, and emotional valence. Also, the TCTSA-Revised (TCTSA-R) introduced by Meijen and colleagues (2020) is considered, which refines the original model to include separate continua for challenge and threat. This segment addresses social antecedents (support and identity), the impact of social interventions, and cognitive predispositions (irrational beliefs), offering a nuanced understanding of how these factors shape stress responses. Finally, the presented biopsychosocial perspective is applied to the motivated performance setting of HE. Recognising the increasing significance of stress in academic settings, the importance of stress for student wellbeing and academic performance is highlighted. A review of the research on challenge and threat states within HE is then presented, encompassing psychophysiological and psychosocial responses to academic stressors, culminating in outlining the program of research presented in chapters two, three and four.

1.2. What is Stress – early developments

1.2.1. Greek Philosophy

Early definitions of stress arose in the works of Greek philosophy, for example, Hippocrates (460-377 BC) and Aristotle (384-322 BC) discuss the importance of internal balance as essential for health. Stress was thought of as an event external to the body (e.g., cold weather or a virus), which disrupts the body's natural balance, often causing disease in the process (Goldman et al., 1996). Such external forces would cause change in the body via pressure (Democritus, 460-370BC), specifically impacting the body's balance of four humors: black bile, blood, yellow bile, and phlegm (Hippocrates, 460-370BC; as cited in Bynum, 1993). This balance disruption

would often to be the cause if illness and prevent restoration (healing) and became the basis for medicine.

However, Atticus (c. 175AD) philosophised that the process of overcoming the effects of stress on the body, causing them to have a ‘glimmer’. Hinting at the potential adversarial growth resulting from the overcoming the stressful event and the related negative perceptions. More recent developments utilise these propositions in the development of therapies for the promotion of physical and psychological health (Ellis, 1957). These would often advocate, not for the removal of stress, but for a review of how we view the stressor and the capacity to cope successfully (DiGiuseppe et al., 2013).

1.2.2. Mind-body dualism and Hooke’s law

In the 1600, Descartes put forward the idea that humans can be viewed as physical machines, inhibited by a non-physical spirit (the mind/soul). The spirit would influence the machine via the nervous system and pineal gland (Descartes, 1637; Lovallo, 2005). Later, Robert Hooke introduced the ‘Law of Elasticity’ to describe how objects respond to external forces/loads. It states that a ‘force’ can extend or compress an ‘elastic body’ by some extent. Hooke (1678) linked his theory to the work of Descartes (1637) on mind-body dualism, to suggest that the extent of the forces (i.e., stress) exerted would ‘stretch’ the body, and the extent of the stretch would determine how and/or if the body returned to its normal state. Similar to machines, repeated force/load applied to the body would eventually cause wear and tear and diminish its ability to return to normal. Whilst this line of theorising has its inherent flaws, it has become the basis of medicine.

The 1800s and 1900s present a key time in the development of modern medicine and an understanding of how life exists and functions. Developments in physiology follow a philosophical dogma where life is viewed as linear, not dissimilar to how a machine functions (Hooke, 1678). When the function stops life no longer exists (Lovallo, 2005). In an attempt to explain the complexity of living organisms, early medicine adopts a reductionist approach, where complex machines (e.g., human body) are made up of smaller machines (e.g., organs) and these machines operate in a

linear fashion for life to exist. Disease is the disturbance to this linearity and treatment restores the linearity (Lovallo, 2005). The work of physiologists like Bernard, demonstrate a development in this concept of life, by highlighting that disease, a disturbance to the normal process of life, can and does exist in circumstances that cannot be explained by physiological disruption (i.e., a mechanical failure). Further developments from Cannon and Selye introduce the concept of 'stress' and the stress response, describing a psycho-physiological response to external pressure that is 'non-specific' to any disease, but has a big impact on the living organism. Although not without flaws, these advances present and important step towards understanding the dynamic interaction between living organisms and the environment they function in.

1.2.3. Claude Bernard

Life in the human body is sustained by maintaining a consistent internal environment, the 'milieu interne' when the external environment changes unfavourably (Bernard, 1865). As a subject of research, the origin of stress dates to the work of Claude Bernard, who specialised in 'experimental medicine, researching the 'milieu interne' of the body (Bernard, 1972). More specifically Bernard hypothesised that the blood circulatory system was responsible for maintaining a stable environment within the body, allowing for life to exist. In his time this was a novel view as organs were believed to be self-sustaining and would be considered independently alive (Robinson, 2018). Bernard, however, suggested that life only exists within the body of mammals, should the external environment begin to impact the body, disrupting its internal equilibrium. The autonomic nervous system would detect any unfavourable changes and signal to the blood circulation to regulate the body's internal environment via a change in consistency or temperature. Later he researched the 'four humors': black bile, blood, yellow bile, and phlegm, that are triggered to restore the uniformity of the milieu interne (Bernard, 1878/1974, p. 188).

1.2.4. Walter Cannon

Bernard's theories were not accepted until 50 years later, when Walter Cannon (1929a,b) drew on them to coin the term 'homeostasis', describing the regulatory processes responsible for the return of the body to a natural state in unfavourable external conditions. In the second edition of his book Bodily Changes in Pain, Hunger, Fear, and Rage, Cannon (1929a) suggested a top-down view of body regulation. More specifically that external stress would cause an acute psychological response, which would elicit a physiological response. In his research during World War One, Cannon focused on understanding the 'traumatic shock', i.e. soldiers tendency to present with extreme outbursts of aggressive or fearful behaviours in the absence of threat. He measured levels of acidosis, the concentration of haemoglobin, and red blood cell numbers in the venous and capillary blood and found a corelation to shock severity (Cannon et al., 1918; Ryan, 2018). Suggesting that hormones play a role in the fear response via a sympatico-adrenal system (Cannon, 1929a).

Cannon (1929b) used his findings to build on Bernard's work, that for life to exist, a stable internal environment must be maintained, and he was especially fascinated with the ways living beings maintain this stable environment. The 'milieu interne' or internal environment of the body (Bernard, 1878), engages with the external environment via the autonomic nervous system. It detects unfavourable changes and works to return the body to its natural state (Cannon, 1929a). He suggested that this 'fluid matrix' of the body, must remain within 'stable ranges' for life to persist in the presence of unfavourable external conditions (Canon, 1929b). These stable ranges are what is known as 'homeostasis', a process created and controlled by the living organism to maintain life (Cannon, 1929b). For example, if a stressor such as low temperature is present in the external environment, this is detected by the autonomic nervous system causing several physiological reactions like shivering, which helps generate additional heat within the body and briefly raise the body's temperature (Haman et al., 2004).

Cannon did not specifically define stress as a psycho-somatic event, but in his later work he suggested that a negative emotional response (e.g., fear)

operates as a disturbance within the body. In some cases, the body's prolonged attempt to maintain homeostasis in response to fear could be fatal (Cannon 1935; Robinson, 2018). In his understanding the disturbance of fear precedes the exhaustion of the body. This view was different to the bottom-up view of psychologists William James and Carl Lange, who's view of the links between emotions and physiology stated that the body's response precedes the emotional disturbance (e.g., running away from danger produces fear, as opposed to fear resulting in running away; James, 1895). In his critique of James and Lange's theory, Cannon (1927) argued that as people are not always aware of their bodily functions (e.g., the function of their liver) therefore, emotions are not likely to be the result of bodily sensation. Instead, he argues that emotions are produced in the thalamic regions of the brain, and the body is activated in response (Goldstein & Kopin, 2007; Robinson, 2018). Cannon continued his work to explain the body's response to disturbances in the environment, however his work remained focused on physiology.

Combining his work on homeostasis and emotional regulation, as driven by the nervous system, Cannon moved to research psycho-physiological responses to a wider range of emotions, leading to his conceptualisation of the Fight-or-Flight response. He suggested that when faced with imminent danger, the autonomic nervous system signals the release of adrenaline (i.e., epinephrine) into the bloodstream, preparing the body to 'fight' or 'flee'. Under the influence of adrenaline, the organs in the body respond with activation (e.g., the liver releases glucose into the bloodstream, the heart rate rises to boost circulation) or suppression (e.g., digestion is suppressed to reduce energy consumption; Bernard, 1865; Cannon, 1929b). Once danger has passed, cortisol is released to downregulate activation and restore organ functions to maintain homeostasis. These neuro-chemical shifts act as information from the central nervous system to the body to ensure survival. These insights were revolutionary and remain the topic of research today. Cannon's Fight-or-Flight response theory is not without limitations; for example, when measured, both 'fight' and 'flight' responses would present with identical symptoms in the body. This made it hard to distinguish one response from the other and relate them to specific external

stimuli. Later, the work of Hans Selye extended this research to define this non-specific physiological response to external stimuli, naming it the ‘stress response’ (Selye, 1936).

1.2.5. Hans Selye

The term ‘stress response’ was coined by Selye (1936), borrowed from engineering and physics where it describes the response (i.e., stress) of a physiological body when under pressure (i.e., the stimulus or stressor). In the literature, the term ‘stress’ is commonly used to refer to the stress response, whereas the stimulus/trigger is referred to as the ‘stressor’. In contrast to Cannon, Selye’s interest was mainly in the long-term impact of stress on the body as opposed to the acute effects of stress. Similarly to Cannon, Selye argued that the stress response is a defence mechanism, where the main purpose is to preserve life. For example, in the General Adaptation Syndrome (GAS; Selye, 1936) theory, the stress response is described as a three-stage process where in the presence of a stressor, the body (1) responds acutely via a general alarm in the presence of a stressor (an acute response like, fight or flight), (2) sustains efforts to maintain homeostasis under continuous stress, but shuts down non-essential to survival functions (e.g., pituitary gland stops producing growth hormones to preserve energy), and the organism appears to be back to normal, (3) exhaustion, once the body can no longer sustain homeostasis under stress it produces a reaction similar to the first acute response or surrenders completely (death). The severity of a stressor and the necessary GAS response can vary, determining the length of the second stage. Selye hinted at the finite resource nature of the stress response, suggesting that once the organism is already mounting a defence against one stressor, any additional stress responses would likely be impaired due to the depletion of coping resource. These suggestions are echoed throughout stress research through to today and are especially relevant for the population being researched in this project (university students). For example, excessive cognitive rumination (i.e., worry) in the build-up to an important event (e.g., exam) may impact one’s

performance due to depletion of energy by the time the event commences (Turner et al, 2024).

These links to pathology and the finite nature of the stress response, have given stress predominantly negative connotations. However, Selye (1976) recognised stress to be a dichotomous concept, where it could relate to both positive (eustress) and negative (distress) outcomes. Selye suggested that repeated exposure to medium levels of stress could be beneficial to the organism in developing the ability to withstand severe stress for longer. This idea has become the basis for training in sports and exercising for health (Lovallo, 2005), as well as for stress inoculation training (Meichenbaum, 1977). This line of inquiry is key as it begins to explain the difference between a maladaptive response to stress and an adaptive one.

Furthermore, these observations generated interest throughout the medical, academic and research communities and led to further developments like the isolation and discovery of the specific neurological and hormonal pathways involved in the stress response (Selye, 1943; Robinson, 2018).

1.3. Stress & Appraisal

1.3.1. Physiological responses to stress

Although a full-scale fight-or-flight mobilisation (Cannon, 1929b) or a GAS response (Selye, 1936) are not likely to be needed, these physiological reactions can be observed in response to modern day stressors (e.g., academic assessment; Segerstrom & Miller, 2004). The mechanisms of these responses have been the focus of Cannon and Selye's research and many others after them. However it is the work of psychologists like Richard Lazarus, that bring forward the mechanisms of the stress response and its consequences. Whilst a complete review of the physiology on the human body is beyond the scope of this thesis, key physiological mechanisms will be reviewed in the conceptualisation of psycho-physiological stress.

Early stress researchers found evidence that the ultimate role of the physiological stress response is to preserve life (Cannon 1935; Selye, 1936). It does so by mobilising a defence in response to an external (e.g., cold temperature) or internal stressor (e.g., fear or anxiety). For example, similarly

to how the body shivers (stress response) in the presence of low temperature (stressor), excessive rumination (stress response) about an important event (stressor) can mobilise the body and mind for action. Depending on the length and extent of mobilisation needed, there are potential short-term/long-term consequences to the organism (e.g., depletion of coping ability; Cannon 1935). Early research defines this mobilisation as non-specific (Selye, 1936), however the specific mechanisms for maintaining homeostasis and responding to a stressor have now been identified. Some of these mechanisms and related behaviours are under conscious control, like mobilising the body to move to a warmer space or put on a layer, when cold. While others are under unconscious control, like the heart pumping to maintain blood circulation. Evidence show that these mechanisms can ultimately be controlled by the Higher brain centres and the Hypothalamus, via the release of neurotransmitters (e.g., cortisol, adrenaline, and noradrenaline) and the Autonomic Nervous System (ANS; Lovallo, 2005; McEwen, 2018). Importantly, this release of neurotransmitters and activation of the ANS are regulatory and protective, as long as they switch off, furthermore these physiological mediators allow us to respond to day-to-day activities, some of which may present themselves as stressors (O'Connor et al., 2021).

Notably the work of Bruce McEwen (1998, 2019) on allostasis and allostatic load has been pivotal in our understanding of the psycho-physiological activation occurring during a stress response. McEwen (1998) differentiated between homeostatic systems (e.g., blood oxygen, body temperature) and allostatic systems (e.g., sleep/awake, supine/standing) based on their tolerance for change and flexibility. Where homeostatic processes maintain internal equilibrium within narrow ranges and allowing for little adaptation, allostatic processes have broader boundaries, allowing for a wider scope of adaptation. Allostasis refers to the body's process of achieving stability through change. Instead of maintaining strict equilibrium like homeostasis, allostasis allows for flexible responses to stressors and environmental demands. It involves the activation of physiological systems—like the ANS, hypothalamic-pituitary-adrenal (HPA) axis, and hormones such as cortisol, adrenaline, and noradrenaline, that help adaptation to stressors (McEwen,

1998). Allostatic load is the cumulative adaptation demand on the body from multiple or repeated stressors. Repeated, excessive or prolonged exposure to allostatic load, i.e., allostatic overload is evidenced to play a role in dysregulation or damage related to physical illness (O'Connor et al., 2021). The activation of physiological mediators involves two physiological mechanisms being triggered during the stress response, the sympathetic-adrenal-medullary (SAM) system and the hypothalamic-pituitary-adrenal axis (HPA), also known as pituitary-adreno-cortical (PAC) system (McEwen, 1998). The amygdala (in the brain) and the hypothalamus activate the ANS, signalling the adrenal glands to release catecholamines (e.g., adrenaline and noradrenaline). This is known as sympathetic activation or the SAM system activation and the resultant release of catecholamines changes the function of a number of organs (Lovallo, 2005; O'Connor et al., 2021). For example, heart and breathing rates are increased, muscle tension is increased, digestive and reproductive systems are supressed, as a result a person may become aware of sensations such as heart pounding, muscles tensing and butterflies in the stomach as the body is activated/aroused (i.e., the fight or flight response). As a result of this rapid activation the hypothalamus triggers the release of cortisol into the bloodstream (HPA axis activation). Cortisol is a complex hormone and has multiple functions (McEwen, 2019), but key to the stress response is the release of energy stored in organs. During the stress response, cortisol increases the mobilisation of proteins and fats, releases glycogen, which is broken down into glucose ready for the brain and muscles to utilise as energy, and it decreases inflammation (O'Connor et al., 2021). Importantly, HPA axis activation is a 'negative loop' (i.e., a parasympathetic activation), meaning that the more cortisol is released the activation of the HPA axis decreases. Receptors on the hypothalamus and the pituitary gland detect changes in cortisol level, inhibiting secretion when levels rise and stimulating it should they fall (O'Connor et al., 2021). In practice, HPA activation is triggered and then self-deactivates to limit the wear-and-tear of the stress response. However, evidence shows that repeated or excessive activation of the HPA axis could lead to increased cortisol output, raising cortisol concentration in the body, increasing allostatic load (McEwen, 1998)

and the possibility for tissue damage and experiences of illbeing (Lovallo, 2005).

Notably, the ANS has two neurological branches, the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS), these are activated rapidly and play a key role in maintaining the dynamic balance of the stress response (O'Connor et al., 2021). SNS activation has been linked to the fight-or-flight response whereas PNS regulates a rest-and-digest response, where PNS activation dominates and works to regulate the acute SNS activation (O'Connor et al., 2021). These processes are under unconscious control but can be studied by measuring the impact of the ANS branches of Blood Pressure (BP) markers, known as the baroreflex (Benarroch, 2008). Specifically, receptors on the blood vessels signal to the brain, which in turn uses the SNS and PNS to produce reflex adjustments in BP via the baroreflex (e.g., increase or decrease in vascular resistance, heart rate and heart rate variability, and myocardial contractility; Thrasher, 2006). This crucial link between ANS and BP is essential for linking the physiological and psychological components of the stress response. More specifically the reflex adjustments in BP, as driven by the ANS, represent the psycho-physiological nature of the acute stress response and can be measured non-invasively.

1.3.2. Psychological responses to stress

Thus far, we have established that a stressor to the body can be either an internal or an external event, where there is potential for harm or disruption to homeostasis and allostasis. However, parallel to physiological research of the stress response, sociological research was observing phenomena such as 'alienation' (Durkheim, 1893), a stress like condition where individuals would exhibit a physiological stress response in relation to social situations, e.g., when prevented from acting in accordance with social norms. Disturbing life situations, as well as responses such as panic, riots, suicide, etc were theorised to be the result of social strain (i.e., stress) within the organism, in the absence of a physiological disturbance (Wolff, 1953). Harold Wolff (1950, 1953) suggested that the stress response is not only triggered by rapidly

changing social events, but because of our perception of these events. An individual's goals and perceptions play a key role in the stress response (Wolff, 1950). Further, developments in cognitive theory began to shed light of the role of emotions in situational responses. Magda Arnold (1960) suggested that emotions arise as a result of one's 'intuitive appraisal' of a situation, a "*more primitive fight or flight type response"* (Lazarus & Folkman, 1984, p.26). Richard Lazarus and colleagues combined these research developments and theorised that responses to psycho-social stressor are the result of higher cognitive functioning and involve a two stage appraisal process (primary and secondary appraisals; Lazarus & Folkman, 1984; Lazarus & Launier, 1978).

During the primary appraisal stage, every stimulus or change in the environment is evaluated based on its potential implications. These can be one of three types: (1) irrelevant (no implication perceived, and no action is needed); (2) benign-positive (a positive implication, no action needed); and (3) stressful (harm/loss has occurred coping with aftermath is needed, or the stress is anticipated, and coping action is needed). In the first and second types of situational appraisal, the implications do not warrant any coping effort on behalf of the person. The third kind of primary appraisal is accompanied by an evaluation of coping potential (the second stage of the appraisal process; Lazarus & Folkman, 1984). This secondary appraisal stage only occurs when coping strategies are needed, i.e., a further evaluation of what, if any, action can be taken. It includes an evaluation of coping options (i.e., outcome expectancy) and the likelihood of their successful execution (i.e., efficacy expectation; Bandura, 1982). The situational factors, if any, that are under the individual's control and their self-efficacy in their ability to achieve a desired outcome often resulting in a problem-focused (acting to resolve the situation) or emotion-focused (acting to regulate emotions) coping.

Lazarus and Folkman's Transactional Model of stress (1984) suggests that in a situation of high personal importance an individual engages in the two stage cognitive evaluation/appraisal process. At the first stage, the Primary Appraisal, the importance and demand of the situation is evaluated and at the second stage, the Secondary Appraisal, the resources available to meet

this demand are evaluated. Depending on how the demands and resources measure in comparison to each other, the individual is either Threatened (Threat state; where demands outweigh the resources) or Challenged (Challenge state, where the resources are sufficient to meet the demands). Coping is a cognitive, emotional and behavioural attempt to meet the demands of, or to reduce the negative consequences of a personally important or stressful situation (Lazarus, 1991). Therefore, a challenge state is where the individual is likely to cope better and experience a higher sense of wellbeing, growth and development (Lazarus, 1991); whereas a threat state is more likely associated with harm or loss (Lazarus & Folkman, 1984). The Transactional model of stress focuses on the interaction of the organism with circumstances and the resultant response - 'coping' (the individual's efforts to manage stress; Lazarus & Folkman, 1984). The combination of physiological and psychological stress response concepts expanded the stress literature by accounting for the dynamic, two way interaction between the body and its environment. This suggests there are no universal levels of stress intensity that would lead to either a challenge or a threat response. Instead, it is the subjectively evaluated balance between stress intensity and coping capacity that drives the resultant states of Challenge and Threat. A challenge appraisal as opposed to a threat appraisal was theorised to aid in situational adaptation. For example, Lazarus and Launier (1978) found that the prospect of receiving a job interview rejection, may be less threatening if the person has secured other job prospects, and thus they may appraise the job interview as a challenge and respond effectively.

Although theoretical, Lazarus and Folkman's view of stress was revolutionary and extensive. It took the concept of stress response from a generally defined as a non-specific response of the body to any stimulus (Selye, 1936) or a stimulus that is likely to produce a disturbance (Basowitz et al., 1955), to defining it as the interaction or relationship between a stimulus and a response. Lazarus and Folkman (1984) argue that a stimulus is only a stressor when it produces a stress response and that a response is only a stress response when it occurs in relation to the stressor. More specifically, they advocate for the study of the mediating factors that impact the stimulus-response relationship (Lazarus & Folkman 1984). Linking back into the

transactional model, the two appraisal stages allow for an evaluation of the stimulus (i.e., the stressor/demand) and the response (i.e., coping capacity) as the primary and secondary appraisals, respectively. This appraisal process produces the distinct states of threat and challenge by evaluating the interaction between stimulus and response, i.e., the demand and capacity for coping with the demand.

1.3.3. Psychophysiological stress

So far, we have reviewed the importance of ANS system alongside SAM and PAC activation as physiological mediators that respond to external (e.g. temperature) and internal (e.g. illness; McEwen, 1998; O'Connor et al., 2021). Also, we have delineated that activation in these systems can be observed non-invasively via observing fluctuations in cardiovascular function (Benarroch, 2008; Thrasher, 2006). Separately, we have outlined that the role of primary and secondary cognitive appraisals in the activation of emotional states (Lazarus & Folkman, 1984). Next, we will review the evidence base for the role of cognitive appraisals and the related emotional states in the activity of physiological mediator systems and how these processes coordinate to produce human behaviour.

Notable contributions were made by Frankenhaeuser and colleagues whose research on the neuroendocrine responses to the cognition based stressors (e.g. performance expectations) support the notion of person environment interaction in the production of the stress response. They used biomedical techniques (e.g., blood sampling, HR, urinary catecholamines) to monitor the stress hormones and catecholamines of their participants both in the lab and in natural settings. Subsequently establishing a methodology by which to measure the stress response in occupational settings via neuroendocrine and cardiovascular reactions (Frankenhaeuser, 1986).

Psychophysiological research (Frankenhaeuser et al. 1962; 1968) found evidence that SAM/PAC activation and the subsequent release of catecholamines and cortisol are corelated with cognitive processes. In one lab based study (Frankenhaeuser et al. 1962), participants exhibited their

strongest stress response (urinary catecholamines and self-report) to a human centrifuge ride only prior to their first ride, and rapidly decreasing for the second ride, regardless of ride intensity (G-level). Frankenhaeuser et al. (1962) interpreted these results as evidence that stress levels are heightened as a function of psychological anticipation and can be lower in subsequent rides as a function of habituation. Another study by Frankenhaeuser and colleagues (1968), observed that higher levels of physiological activation (catecholamine excretion and HR) was related to better performance on a Stroop task (Stroop, 1935) and lower reports of 'feeling stressed'. Subsequently, Frankenhaeuser and Johansson (1976) established that an increase in the number and level of stressors in the environment produced a measurable increase in catecholamines (adrenaline) and HR. However, as they observed that participant performance (again on a Stroop task) remained stable regardless of the increased stress and stress response, they interpreted their finding as participants' effort increasing to meet the combined demands of the task and stressor. As a result, they hypothesised that cognitive processes may impact effort and performance.

To test their hypotheses, Frankenhaeuser and Lundberg (1975) exposed participants to an auditory stressor (white noise), while performing an arithmetic task in two sessions. In the first session, participants were exposed to one of three levels (low, medium and high) of white noise and in the second session, all participants were exposed to a medium noise level. Their performances and activation across both sessions were compared to their individual baselines. Interestingly, changes in performance during the second session were relative to the first session rather than the noise intensity, indicating the impact of non-physiological factors. The study also measured participants' subjective ratings on concentration and discomfort (cognitive appraisals), heart rate (HR), and urinary catecholamines. Their results demonstrate that all levels of the stressor produced the same level of physiological activation (HR and catecholamines), but different levels of performance in the first session, as expected with a finite resource availability hypothesis of performance. Interestingly, performance in the second session followed the trajectory of the first session as opposed to a

stressor level change (from low to medium and from high to medium level) trajectory, highlighting the role of cognitive appraisals in performance in the presence of a stressor (Frankenhaeuser & Lundberg, 1975). This line of research is indicative of the dynamic relationship between cognitive appraisals, ANS arousal, emotions and task performance.

In turn Richard Dienstbier' s (1989) theory of arousal and physiological toughening specifically argued for the use of the term *arousal* to represent the ANS activation in response to stimuli. Aiming to take the negative connotation of the term stress response, suggested a framework of arousal and physiological toughness where ANS arousal in response to stressor can potentially lead to *toughening* of the organism and a more efficient response to future stressors (i.e., an adaptive response). Specifically, in positively valanced arousal (challenge) in response to achievement situations (e.g. students; Johansson et al., 1973), SAM activation would trigger the release of catecholamines. Saturation of catecholamines would lead to increase in heart rate, beats per minute (HR, bpm), a reduction in pre-ejection period (PEP), and decreased total peripheral resistance (TPR) in the blood vessels, together allowing for increase in cardiac output (CO) and an effective delivery of oxygen and glucose to the brain and muscles, resulting in enhanced performance. However, when arousal is experienced as a negatively valanced event (a threat), similarly SAM activation and release of catecholamines would increase HR, bpm and reduce PEP. However, additional PAC activity, the release and saturation of cortisol would cause TPR to increase, restricting CO and the amount of glucose and oxygen delivered to the brain and muscles (Dienstbier, 1989; 1992). Dienstbier proposes that repeated exposure to achievement situations would lead to a 'toughening' of the organism, a decreased likelihood of becoming threatened, and superior task performance (e.g., in academia). Whilst some found contradicting evidence to the arousal and physiological toughening formulation (e.g., Jamieson et al., 1994), the related predictions have been largely supported (e.g., Seery, 2010; Tomaka, 1993) and have become the basis of further theoretical developments such as the Biopsychosocial model of challenge and threat (Blascovich & Mendes, 2000; Blascovich & Tomaka, 1996).

1.3.4. Biopsychosocial model (BPSM) of challenge and threat

Historically, stress research has come to similar conclusions. Firstly, stress is a psycho-physiological arousal, in other words, it is a complex system of physiological activation accompanied by cognitive appraisal of the stressor as it relates to the individual's capacity for coping effectively. Second, stress is debilitative to wellbeing and functioning mainly where the individual is unable or prevented from coping physically or psychologically (resulting in a state of *threat*). Third, where an individual is appraising themselves as able to cope with the demands of a stressor an adaptive response may occur (resulting in a state of *challenge*). Following the work of Lazarus and Folkman (1984) and Dienstbier (1989), Jim Blascovich and colleagues (Blascovich & Mendes, 2000; Blascovich & Tomaka, 1996) took the appraisal based model and proposed an integrative, interdisciplinary approach to understanding how psychological activity and physiological arousal are related in motivated performance situations. Similar to appraisals of demands and coping capacity (Lazarus & Folkman, 1984) the biopsychosocial model of arousal regulation (BPSM; Blascovich & Tomaka, 1996) applies to situations and outcomes of high personal importance to the individual.

Blascovich and Mendes (2000) define motivated performance as a situation of high personal importance to the individual, where they are required to actively perform a skill (e.g., give a speech, problem solve, compete). In other words, when and individual is in a situation where they expect to exert active effort to perform, doing so is aligned with their subjective goals and adequate performance is necessary to their continued wellbeing and/or growth. The BPSM suggests that the psycho-physiological state of activation (challenge or threat) is measurable during metabolically inactive performance (i.e., in the presence of high psychological demand relative to physical demand, e.g. speech giving, math problem solving, in preparation for physical competition) due to the broad variability of activation across metabolically demanding performance (e.g. sport competition). As a result, subsequent physical performance (e.g. sport) literature has adapted to this

limitation by measuring activation states in the build-up to metabolically demanding performance (e.g. speech about competitive season sport performance; Blascovich et al 2004), or via lab-induced performance activation states (e.g., vignette).

Stress according to the BPSM is conceptualised as an affective state, where challenge and threat represent the arousal of emotion and the related motivation to move/take directed action, either towards or away from what arouses the emotion. The neurochemical presentation of emotional arousal in the body is often accompanied by matching self-reports of emotional experiences. Stress research has adapted two approaches to examining the neurological (ANS activation) and endocrine (release of hormones) presentation of arousal under stress as *positive stress* (i.e. challenge) and *negative stress* (i.e. threat), as represented by neuroendocrine indexes for each (Mendes & Park, 2014). Challenge and threat states are conceptualised on the basis that the arousal of stress in the body can be related to either an adaptive or a maladaptive emotional experience. For example, where a stressful situation is evaluated to hold the potential for harm, the person is likely to report negative emotions and a desire to escape (motivation to avoid the threat) the situation. Where a stressful situation is evaluated to hold a potential for gain or growth, the person is likely to report positive and/or negative emotions and a desire to rise to the challenge.

Due to the complex nature of human motivation, arousal responses and their related behavioural outcomes cannot be explained by a unidimensional theory but instead warrant a multi-level approach (Blascovich & Tomaka, 1996). In a motivated performance situation, the resultant response (challenge or threat) depends cumulatively on the specifics of the situation (at the primary appraisal stage), the individual's physiology (physical capability and neuro-endocrine response) and psychology, and socio-cultural determinants (at the secondary appraisal stage). According to the BPSM, the concept of arousal is an adaptable frame that includes multiple arousal constructs (e.g., affect, stress) and their measurement strategies, to be applied to a specific motivated performance context (e.g., academic examination). Arousal regulation as a biopsychosocial occurrence, under conditions of personal importance (goal-relevance), where the individual is

required to take immediate overt or cognitive action (Blascovich & Tomaka, 1996). The BPSM expands primary appraisal theory (Lazarus & Folkman, 1984) to include an evaluation of situation demand, uncertainty and/or danger, and secondary appraisal to include the perceived resources/coping abilities, such as confidence, belief in a just world and control. The BPSM aims to be a general framework of the adaptive (challenge) and maladaptive (threat) responses to personally important situations. It further aims to quantify and account for the measurable factors that determine a Challenge/Threat state and relate these to situational outcomes.

More specifically, biological factors (e.g., genetics, anatomy) as moderated by physiological processes (e.g. maturation) define the range of responses available to the individual (Blascovich & Tomaka, 1996). Cognitive appraisals of coping capacity, moderated by personal (e.g. self-efficacy) and social factors (e.g. the presence of others) then determine the situational response based on the physiological range of responses available to that individual (Blascovich & Tomaka, 1996). These psycho-physiological factors are theorised to account for the individual-differences in responding to the same situation. For example, when a person is faced with a motivated performance, they undergo a two stage cognitive appraisal process (similar to the Transactional model; Lazarus & Folkman, 1984). At the primary appraisal stage they would evaluate the degree of demand, uncertainty and danger involved. At the secondary appraisal stage, they would evaluate the degree of perceived resources or abilities/skills they possess to meet the demands of the situation. Where the demands outweigh the perceived resources, a psycho-physiological threat is the overall appraisal, accompanied by negative emotions. When the resources are perceived as sufficient to meet the demands, then challenge response occurs, accompanied by emotion- or problem-focused coping efforts (Blascovich & Tomaka, 1996; Lazarus & Folkman 1984).

The BPSM, as the name suggests incorporates psychological, social and physiological factors to explain the arousal process. Firstly, the situation-appraisal link can be moderated by various factors. These factors include intrapersonal factors such as, self-esteem, belief in a just world, a sense of control, knowledge, past experiences, and attitudes, as well as affective

states (Blascovich & Mendes, 2000; Blascovich & Tomaka, 1996). Interpersonal factors such as the presence of evaluative others, liking, and social identity are also suggested to moderate the situation-appraisal link. Biological factors such as genetic, structural, and functional factors also play a role in mediating the goal-relevant, situation-physiological arousal component of the BPS model. Next, the appraisal process transpires into physiological arousal and emotional experience before, finally resulting in a behavioural response (see Figure 1.1).

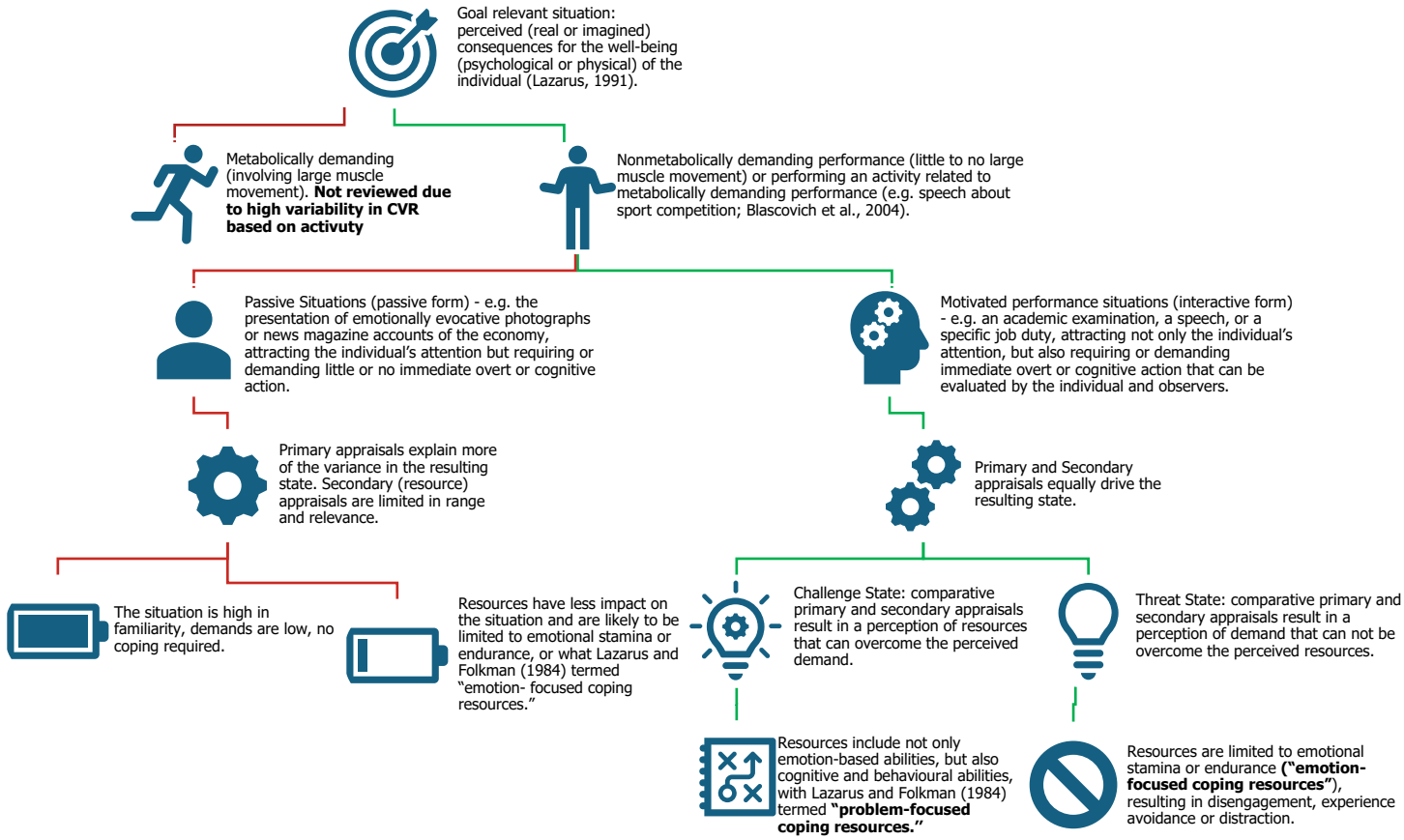


Figure 1.1 The Biopsychosocial model of Challenge and Threat responses to motivated performance, representing theory limitations, links to Cognitive appraisals theory and the predicted, resultant coping response (emotion- or problem-focused coping).

The BPSM specifies cardiovascular (CV) indices used as a determinant of a motivated performance situation and subsequent challenge and threat responses. These are heart rate (HR), ventricular contractility (VC), cardiac output (CO), and total peripheral resistance (TPR). HR is the number of times the heart beats per minute. VC is the force of the left ventricle's

contraction, calculated by multiplying PEP (pre-rejection period) by -1, where a larger VC value reflects greater VC. CO is the amount of blood in litres pumped by the heart per minute. TPR is the net constriction versus dilation in the vascular system; it is calculated by dividing mean arterial pressure by CO and multiplying it by 80 (Blascovich et al., 2003; Sherwood et al., 1990). An increase from baseline on HR and VC is indicative of a motivated performance activation. A challenge response is indexed by a rise of CO and reduced TPR, whereas a threat response is indexed by stabilisation or an increase in TPR and little or no change in CO from baseline (Blascovich et al., 2004). It then follows that in relative terms, if TPR is lowered, more blood is allowed to circulate (higher CO) to the brain and muscles, delivering glucose and oxygen, thus energising the body and mind for performance.

The BPSM has received increasing interest and application to performance contexts. For example, Blascovich and colleagues (2004) argued that cardiovascular indicators of motivated performance (HR, VS, CO and TPR) can be used to bridge the gap in predicting performance in goal-relevant contexts (sport). They asked baseball and softball athletes to give a sport-relevant speech and found that CO and TPR responses during the speeches predicted actual athletic performance during the following season. Despite the methodological limitations such as sample size and lack of control for previous season performance and dropout in the analysis, these early example of the predictive potential of motivational states (challenge and threat) played a pivotal role in highlighting the importance of psychological processes in performance contexts.

Similarly, Mendes and colleagues (2001) presented evidence for the role of social factors such as upward/downward comparisons and attitudinal similarity in the presentation of motivational states. Their findings draw links between affect (positive and negative) and motivational state (challenge and threat) as they relate to social evaluations. More specifically, findings demonstrate that participants who engaged in downward comparisons (appraising themselves as superior in a social comparison) exhibited higher levels of positive affect and a challenge response. Concurrently, participants

who engaged in upward comparisons (appraising themselves as inferior in a social comparison) exhibited higher levels of negative affect and a threat response. Additionally, participants' appraisals of demands and resources (measured based on Tomaka et al., 1993) were impacted by the social factors.

Finally, the BPSM highlights the importance of affective cues in challenge and threat appraisals and responses. Blascovich and Mendes (2000), outlined affect, as a key psycho-physiological component of BPSM. Positive and negative affect serve as core relational themes of appetitive (approach) and aversive (avoidance) physiological states (Lazarus, 1991; 1999). Encounters that produce an appetitive experience are more likely to be sought out and pursued due to natural instincts. These are likely appraised to lead to positive feelings, often informed by past experiences. Whereas, situations that are likely to produce an aversive experience are more likely to be avoided, due to their appraisal as potential for inducing negative feelings. In other words, research (e.g. Blascovich et al 2004; Mendes et al., 2001) suggests that individuals who appraise themselves as able to cope or as superior in comparison are more likely to experience positive affect and exhibit a challenge response, as well as perform better under pressure (Hase et al., 2019). The related positive impacts of a challenge, as opposed to a threat state have also been related back to health and wellbeing in performance contexts (Epel et al., 2018; Jamieson et al., 2016; McLoughlin et al., 2024) and leading to the development of successful interventions (e.g., Jamieson et al., 2021;).

The BPSM framework whilst not without flaws, takes a holistic view on arousal response, suggests practical methods of measurement, and aims to relate it to predictable outcomes. As a multidisciplinary model it integrates multiple levels of analysis and methods. It incorporates dispositional, cognitive, physiological, and social dimensions of arousal regulation. Individual differences such as a personality (e.g., Schneider et al., 2011), just world beliefs (Tomaka & Blascovich, 1994) and assertiveness (Tomaka et al., 1999) were evidenced to interact with challenge and threat appraisals to impact on wellbeing and performance.

1.4. The Theory of Challenge and Threat States in Athletes

1.4.1. The Theory of Challenge and Threat States in Athletes (TCTSA; Jones et al., 2009)

The Theory of Challenge and Threat States in Athletes (TCTSA; Jones et al., 2009) and the revised TCTSA (TCTSA-R; Meijen et al., 2020) take the general framework of the BPSM and apply it to sporting performance (e.g., Blascovich et al., 2004), working memory performance (e.g., Chen & Qu, 2021), policing (e.g., Jones et al., 2020), childbirth (Meijen, 2023), and other performance domains. The TCTSA offers an amalgamation of the BPSM (Blascovich & Mendes, 2000; Blascovich & Tomaka, 1996), with the model of adaptive approaches to competition (Skinner & Brewer, 2004) and the debilitative and facilitative competitive state anxiety model (Jones, 1995; Jones & Swain, 1995). Like the BPSM, the TCTSA suggests that in motivated performance domains, how an individual responds, is primarily influenced by their appraisal of situational demands and resources available to meet them. More specifically, emotional valence can both impact and be indicative of a challenge or threat state and have been evidenced to predict performance (Skinner & Brewer, 2002). Additionally, key to the impact of emotional valence and appraisals is weather these are perceived by the individual as facilitative or debilitative to their performance (Jones, 1995; Jones & Swain, 1995). The TCTSA suggests that emotional valence is especially sensitive to the balance of situational demands and coping resource appraisals. Furthermore, it ~~diverges~~ builds on the BPSM to specify four resource appraisals relevant to performance domains, namely self-efficacy (Bandura, 1997), control (Jones et al., 2009), and achievement goals (Elliot & McGregor, 2001).

1.4.2. Demand and resource appraisals

The TCTSA (Jones et al., 2009) suggests that challenge and threat states arise during motivated performance situations. In these situations, performers appraise the situation and its outcomes as personally important, such as athletic competition or academic examinations. At the primary (i.e., demand) appraisal stage, they perceive the situation and outcomes as uncertain, requiring effort to achieve desired outcomes like placing in a competition or getting a good grade. Not achieving these outcomes could negatively impact their self-esteem. Next, at the secondary (i.e., resources) appraisal stage, performers evaluate their task self-efficacy, control, and goals. Self-efficacy is the belief in possessing the necessary skills to perform the task successfully (Bandura, 1997). Control involves the ability to act on one's skills and acceptance of limitations. Achievement goals refer to mastery and performance goals, aligned based on approach and avoidance in a 2x2 framework (Elliot & McGregor, 2001).

Notably, the strength and extent of challenge and threat response is likely to match the level of subjectively appraised situation importance (Jones et al., 2009; Lazarus, 1991). For example, a student's physiological and emotional response prior to talking with fellow students or their lecturers may be less intense than that prior to delivering a presentation for academic assessment. Like the BPSM, the TCTSA stipulates that high importance of the event is a prerequisite for challenge and threat states to occur (Blascovich & Mendes, 2000; Jones et al., 2009). Hence, the presence of high importance is measured in challenge and threat research, as it is in the present research.

Next, situational demand appraisals in a motivated performance context include perceptions of danger, uncertainty and effort required (Jones et al., 2009). Historically, demands in accordance with challenge and threat theories has been either measured via psychometrics (Tomaka et al., 1993) or made salient/reinforced through study design (Moore et al., 2012). For example, Moore and colleagues (2012) manipulated challenge and threat responses via task instructions prior to golf putting performance. They found that the challenge instructions predicted not only more helpful emotions, but

superior skill execution (effective gaze, kinematics and muscle activity) and outcomes (accuracy). Whilst TCTSA research has adopted the BPSM measure of demand and resource appraisals (Tomaka et al., 1993), this two item measure asking participants to indicate 'how demanding' a task is and 'how able they are to cope with the demands' if the task, does not capture the specific demand and resource appraisals suggested by TCTSA. This presents a key limitation in TCTSA, which aims to add specificity to challenge and threat appraisals. The current thesis is grounded in the context of higher education (HE) and will proceed to apply a challenge and threat perspective under the assumption that HE performance inherently presents high performance demands (e.g. high effort required, uncertainty of skill/knowledge acquisition).

Unlike demand appraisals, a universal set of resource appraisals has been comprehensively outlined and supported in the formulation of the TCTSA. The three inter-related constructs of self-efficacy, control and goal orientation play a key role in determining a challenge/threat response to a motivated performance situation (Jones et al.,2009). Firstly, self-efficacy is the belief that the individual possesses the necessary skills to execute the courses of action required to succeed at the task at hand (Bandura, 1982). Research on self-efficacy has demonstrated that these beliefs can be enhanced prior to a performance, by reviewing past successful skill executions (personal or by others' Bandura 1986), through verbal persuasion, imaging of successful skill execution (Bandura 1997) and by interpreting emotional activation as facilitative (vs. debilitative) to performance (Jones, 1995). For example, a student who believes themself to have the necessary skills to acquire knowledge is more likely to experience a challenge response in an academic context (Turner et al., 2024).

Second, control appraisals, draw on the balance between objective control and perceived control, where the experience of control is dictated by the level of perceived/subjective control (Skinner, 1996). Jones and colleagues (2009) suggest that high self-efficacy may be insufficient to produce the superior 'challenge response' and subsequent successful performance in the

absence of high perceived control. Furthermore, they suggest that perceived control is the intentional cognitive focus on what is objectively controllable as opposed to what is not. As such our student example expands to suggest that self-efficacy about knowledge acquisition must also be supported by focusing on objectively controllable factors (e.g., dedicating study time, attending exams, asking for feedback) as opposed to objectively uncontrollable factors (e.g., technology failures, examiner decisions).

Third, responses in a motivated performance situation have been evidenced to vary depending on the goal orientation of the performer (Roberts et al., 2007). Achievement goal theory (Elliot & McGregor, 2001) suggests the existence of two distinct types of goals, 'mastery goals' (e.g., personal improvement, skill development) and 'performance goals' (e.g., comparison, demonstrating superiority). These are further split into approach and avoidance components resulting in a 2x2 achievement goal framework. Mastery approach (MAp) goals reflect a desire to improve on a self-referenced target, e.g., "I would like to improve my writing this semester". Mastery avoidance (MAv) goals reflect a desire to avoid underperforming based on a self-referenced target, e.g., "I don't want to do worse than last semester". Performance approach (PAp) goals reflect a desire to be perceived as superior in comparison to others, e.g., "I want to get the highest grade in class". Performance avoidance (PAv) goals reflect a desire to avoid being perceived as inferior in comparison to others, e.g., "I don't want to get the lowest grade in class". Evidence supports that students who express mastery and PAp goals related to challenge appraisals, while PAv goals related to threat appraisals (Elliot & McGregor, 2001). Jones and colleagues (2009) suggest that achievement goals are likely to present as a resource appraisal, where approach goals are supportive of a challenge response and avoidance goals are supportive of a threat response. In other words, a student appraising high control, and high self-efficacy, along with a focus on demonstrating competence in HE, is more likely to respond to HE as a challenge as opposed to a threat.

1.4.3. Challenge and threat physiology

Physiologically, the TCTSA adopts the same approach as the BPSM. When the resources are appraised as sufficient to meet the demands of the situation a challenge state is the result (increased CO and reduced/stable TPR). In this process, energy and free fatty acids become readily available to the brain and muscles to fuel effective decision-making, cognitive function, and improved anaerobic power (Jones et al., 2009). However, when the demands are appraised to outweigh the resources, a threat state is the result. In this process, the increase in SAM activity, followed by an increase in PAC activity, leads to the release of cortisol, which serves to stabilise or increase TPR, thus decreasing or stabilising CO. The increase in PAC activity serves to neutralise SAM activity, thus decreasing energy availability to the brain and muscles, and efficient functioning (Blascovich & Tomaka, 1996).

1.4.4. Emotional valence and performance outcomes

Finally, the TCTSA, adopts a similar view on emotional responses as the BPSM (Blascovich & Mendes, 2000) and the model of adaptive behaviours (Skinner & Brewer, 2004). A challenge state is likely to be accompanied by positive and negative emotions, and a threat state is likely to be accompanied by negative emotions. However, the TCTSA goas a step further in specifying that emotions in a challenge state are more likely to be perceived as facilitative to performance, whereas in a threat state as debilitative to performance (Jones, 1995; Skinner & Brewer, 2004). Research evidence has consistently supported the facilitative/debilitative emotion appraisals component of the TCTSA. A control group comparison study by Moore and colleagues (2015), found that despite initial threat responding and poor performance, participants who were asked to reappraise their emotions as facilitative to performance, subsequently went on to exhibit a challenge response and to outperform control group participants. In an attempt to replicate these results, Sammy and colleagues (2017) tested participants

challenge and threat appraisals and response to, and performance on a dart throwing task. They found that when participants were asked to reappraise performance pressure as facilitative rather than debilitative, this led to higher reporting of resource appraisals, increases in CO and decreases in TPR (indicative of a challenge response). However, reappraisal did not produce a measurable on task performance (Sammy et al., 2017).

1.4.5. Research across domains

Although initially developed to be applied in an athletic competitive setting, the TCTSA has been applied across performance domains. Researchers have found that challenge and threat states arise during performance in both familiar (Vine et al, 2015) and unfamiliar (Moore et al, 2014) skills, impacting skill execution. For example, Vine and colleagues (2015) found that aviation pilots' demand and coping appraisals significantly impacted their performance on aircraft crash simulations. A threat appraisal to the simulation significantly disrupted the pilot's attention control, when controlling for the pilot's age and years of flying experience. Similar effects of participants' demand/recourse appraisals and cardiovascular challenge/threat response patterns were observed during the performance unfamiliar lab based task (laparoscopic surgery; Moore et al., 2014). Where resources were evaluated as sufficient to meet the demands of a given performance situation, TPR lowered and CO increased, participants displayed higher skill accuracy and performance efficiency. Where resources are not evaluated as sufficient to meet demands TPR increased, CO decreased, performance accuracy and efficiency were negatively impacted (Moore et al., 2014).

Challenge and threat appraisals have also shown to impact performance in field based research. Roberts and colleagues (2015) found that doctors' challenge appraisals were linked to better performance at selection centres for recruitment to anaesthesia training programmes. Separately, psychological interventions can be utilised to enhance challenge appraisals.

For example, psychological resources can be made salient through manipulating task instructions (Moore et al, 2012) or via imagery scenarios (Williams et al., 2017), by emphasising participant's efficacy and control ultimately resulting in challenge cardiovascular responses and effective coping. Evidence demonstrates that effective coping with the stress of performing under pressure is a key factor impacting on the performer's experience and performance outcomes. In higher education, Jamieson et al., (2016) found evidence that arousal reappraisal increased resource evaluations, suggesting that interventions can effectively promote a psycho-physiological challenge response in an educational setting.

In summary, the TCTSA is a framework for understanding the underlying psycho-physiological mechanisms of human performance under pressure (e.g., athletic competition). It posits that appraisals of self-efficacy, control and achievement goals determine a person's response to performance in domains of high personal importance. These responses distinctly present as increase in epinephrine and cardiovascular activity, combined with a decrease in TPR and increase in CO for a challenge state, and increase in TPR and decrease/no change in CO for a threat state (Jones et al., 2009). Furthermore, the TCTSA postulates that emotions, positive and negative, which are perceived as facilitative to performance are indicative of a challenge state. Whereas negative emotions and their interpretation as debilitative to performance, are indicative of a threat state. In proposing a dichotomous view of responses to performing under pressure, the TCTSA aims to provide a framework for practitioners to enhance performance (Jones et al., 2009).

Since its inception the TCTSA's predictions about challenge and threat states and their impact on performance have received high research interest, but not all predictions have been supported (Meijen et al., 2020). Interestingly, one of the key criticisms of challenge and threat theorising arises in response to the physiological manifestation of a threat state. SAM activity is indeed fast acting and the release of catecholamines (i.e., the neurotransmitters epinephrine and norepinephrine) has an almost instantaneous and visible

impact on the body (Panawala, 2017). However, PAC activity is slow acting and the release of cortisol (a hormone, not a neurotransmitter; Panawala, 2017) takes longer to saturate in the organism to produce a measurable impact as recorded by challenge and threat research (Meijen et al., 2020). Research evidence shows that the pre-performance presence of elevated cortisol has been linked to psycho-physiological manifestations of a threat state and behavioural outcomes such as poorer performance (Ponzi et al., 2021). The acute challenge/threat response (detected by most challenge and threat research) may be biased by challenge/threat cognitions and or predispositions occurring outside the immediate pre-performance timeframe. The more recent TCTSA-R (Meijen et al., 2020) developments outline this and other gaps in the literature since the inception of TCTSA (Jones et al., 2009) and further research is necessary into the role of cortisol in the acute arousal process.

1.5. The Theory of Challenge and Threat States in Athletes – Revised (TCTSAR; Meijen et al., 2020)

Theorising about challenge and threat states has transformed through the last decade and has recently aligned more closely to the original cognitive appraisal theory of Lazarus and Folkman (1984) in two ways. Firstly, Lazarus and Folkman (1984) specify that primary and secondary appraisals were not intended to precede one another. Instead, the two types of appraisals may co-occur and change dynamically as an event develops, or the person acquires new information. It is then unrealistic to believe that challenge and threat are likely to lie on a single continuum (as suggested initially by TCTSA and BPSM) as a person's state may change on a moment by moment basis as evaluations change. As a result, the dualistic view of earlier challenge and threat theorising has seen contradicting evidence (Meijen et al., 2020). TCTSA-R lays out the appraisal process as a two stage cognitive evaluation process, which is repeated as the stressful/activating event takes place and progresses. In this formulation the resultant challenge-threat states are more

of an amalgamation of a dynamic appraisal-reappraisal process, where the resultant coping outcome is successful or unsuccessful with varying stages of likelihood. This outcome is therefore dependant on where the individual places on the two separate scales of Threat and Challenge and the resultant emotional valence and perception. Importantly, the TCTSA-R (Meijen et al., 2020) allows for the possibility that an initial threat response at Primary appraisal can be mitigated at the Reappraisal stage in the dynamically developing event. More specifically, through intervention the likelihood of potential fulfilment can improve by making psychosocial resources more salient (Zwettler et al., 2018).

Second, cognitive appraisal theory (Lazarus & Folkman, 1984) is grounded in social context, meaning that emotional responses often arise from and/or are influenced by the appraisal of social interactions/relationships (Lazarus, 1999). Appraisals are impacted in varying degrees by the broader context of personal experiences of coping with demands and constraints, perceived opportunities for advancement and social/cultural practices (Lazarus & Folkman, 1984). For example, a student delivering a graded presentation may appraise not only the demands of the situation and their coping resources, but these are likely to be influenced by their beliefs (e.g., that they are good/bad at presenting) and by the social environment (e.g., if their peers are supportive).

1.5.1. The influence of social factors on challenge and threat

The revision of the TCTSA (Meijen et al., 2020) highlights that the initial conceptualisation by Jones and colleagues (2009) focuses on the role of personal resources appraisals. Meijen and colleagues (2020) review the emerging evidence base and build a strong case for the consideration and inclusion of social influences on challenge and threat responses. Consequently, Lazarus and Folkman (1984) included both personal and social resources and outlined their role in primary and secondary appraisals of challenge and threat. Additionally, social facilitation has long been

suggested to impact performance, e.g., cyclists cycle faster in the presence of others as opposed to on their own (Triplett, 1898).

Social support is a resource exchange between two or more individuals, where the recipient's wellbeing (Shumaker & Brownell, 1984), self-confidence (Freeman & Rees, 2010) and response to burnout (DeFreese & Smith, 2014) have the potential to be enhanced. Additionally, if this resource exchange is available from a group that a person (in this case, a student) shares an identity with or feels connected to, this further enhances the benefits of this social resource (Haslam, 2014; Slater et al, 2016; Haslam et al, 2019). For example, where an individual feels a strong connection with their social group (e.g. their work and/or organisation) they are more likely to appraise higher availability of social support from others who share this identity (Gillman et al., 2023).

The perceived availability of social support in organisations has been evidenced to impact directly on primary and secondary appraisals during skill execution, and on skill performance (Tamminen et al., 2019). One way by which social support is predicted to impact skill performance is by reducing the appraised stressfulness of a situation (Cohen, 1988). Another, emphases the specific types of supportive interactions that are likely to increase one's appraisal of coping resource availability (Bianco & Eklund, 2001). Social support provisions such as (1) emotional (e.g., feeling cared for and comforted), (2) esteem (e.g., sense of competency and ability is bolstered), (3) informational (e.g., direct advice and guidance), and (4) tangible (e.g., concrete assistance with task execution), are the 4 types of support evidenced to impact skill performance directly and indirectly (Freeman et al., 2011). Thus, the way that the availability of social support is appraised can establish as a coping resource.

Psychophysiological research using neuroimaging highlights the role of others in emotional responses, especially rapid responses to potential threats (Maratos, 2011). Additionally, psychosocial interventions have demonstrated to have a larger impact on athlete performance when delivered by a known coach (Brown & Fletcher, 2017), pointing to the potential impact

of social networks on resource appraisals. Some lines of research have found that a shared social identity impacts effort mobilisation and resource appraisals (Miller et al, 2021). Others, suggest that perceptions of social support availability have a direct impact (Rees et al, 2007) and a stress buffering effect on performance under pressure (Rees & Hardy, 2004). Furthermore, social support and social identification have demonstrated to have a stress buffering effect for wellbeing in occupational settings (Gillman et al., 2023). Separately in sport, the perceived availability of social support can buffer for stress during injury recovery and indirectly aid in the overall return to athletic performance (Mitchell et al., 2013).

A key study by Wilkins and colleagues (2015) investigated the relationships between identity (social and organisational), study commitment, academic achievement and student satisfaction of business/management students across two HE institutions. The study found that organisational identification was the strongest predictor of academic achievement, followed by commitment and satisfaction. In turn social identity, exhibited a small but significant direct effect on academic achievement. Thus highlighting the importance of organisational identification for students performance in their studies.

Another study by Zwettler and colleagues (2018) tested the cross sectional corelations between students' social identification and emotional/cognitive markers of examination anxiety, such as worry, depression, insecurity and achievement motivation. Findings suggest that a strong identification with fellow students corelates with higher stress levels, but lower depressive symptoms and social insecurities. Additionally, a stronger identification with the academic programme, correlated with higher achievement motivation and lower depressive symptoms. From a wellbeing perspective however, the strongest correlation found suggests that feeling insecure about social connectedness was related to depressive symptoms. Although, the study offers correlational findings only, these point to a potential positive impact of social identity and belonging on student wellbeing and examination performance cognitive appraisals. Similarly, Slater et al. (2018) found that

participants who report stronger relational identification reported higher resource appraisals (confidence, control, achievement goals) when approaching a lab based pressurised task and performed better.

Social factors have been evidenced to impact performance in motivated performance settings, especially if the presence of others is appraised as facilitative or debilitative to performance. For example, a study by Mendes and colleagues (1999) asked participants to perform either a familiar or an unfamiliar task, either by themselves or with an audience, while measuring cardiovascular responses. They found that performing with an audience elicited a challenge response for the familiar task and a threat response for the unfamiliar task. In contrast, participants performing alone did not differ based on whether they performed a familiar or unfamiliar task. Their findings emphasise the social facilitation impact on challenge and threat responses, further emphasising the importance of social context for performance.

Separately, social comparison has also been evidenced to impact challenge and threat appraisals, states and skill performance. Mendes and colleagues (2001) found that participants who were told they were performing better than an experimental partner (i.e., made a downward comparison) were more likely to be challenged. When participants were told they were performing worse than a partner (i.e., upward comparison) they were more likely to be threatened. Similarly, Behnke and Kaczmarek's (2018) research applied challenge and threat theory in competitive computer gaming. They observed that experienced gamers, who held beliefs about being better (i.e., downward comparison), consistently demonstrated a challenge state and outperformed other gamers.

1.5.2. Impact of social intervention on challenge and threat states

A key study by Evans and colleagues (2022) has brought together key challenge and threat theory and social connectedness to benefit academic transitions of students into higher education. Evans et al. (2022) aimed to

help students manage the stress related to higher education by boosting students' perceptions of resource availability during their transition into academia. They wanted to make salient students' confidence and existing coping resources while boosting students' sense of social connectedness. To achieve this, a single coping oriented personal disclosure mutual sharing (COPDMS; Evans et al., 2018) session was delivered with students in their introductory week. As a result, participants reported a positive stress-buffering impact, including increased confidence, connectedness and perceived availability of support (Evans et al., 2022). While study results can be interpreted only in light of methodological and practical limitations. This line of enquiry sets the basis for further applied research in to applied avenues to improving students coping skills under academic pressures.

Personal-Disclosure Mutual-Sharing (PDMS; Dunn & Holt, 2004) is a communication-orientated intervention that originated from counselling settings and is used to enhance participant self-awareness, empathy, and socioemotional bonds through the public sharing of unknown meaningful stories (Dunn & Holt, 2004; Evans et al., 2013; Evans et al., 2022). PDMS facilitates shared perceptions and mutual understanding through a collaborative process of personal-disclosure (Dryden, 2006) and reflective listening (Yukelson, 2010), in groups. This process can subsequently provide a platform for collective psychological and social constructs (e.g., coping and shared identity) and understandings to emerge (Windsor et al., 2011).

There are currently four types of PDMS: Relationship-Orientated (ROPDMS; Dunn & Holt, 2004), Mastery-Orientated (MOPDMS; Barker et al., 2014), Rational-Emotive (REPDMS; Vertopoulos & Turner, 2017), and Coping-Orientated (COPDMS; Evans et al., 2018). Moreover, COPDMS was developed by Evans et al., (2018) and is used to allow participants to share information relating to demand and resource appraisals (Lazarus, 1999) associated with previous and future transitions. For instance, Evans and colleagues (2018) used COPDMS to increase athlete self-awareness regarding the demand and resource appraisals (Lazarus, 1999) required to

function effectively when faced with career-related challenges such as gaining a professional contract or being released from a team.

Most recently, within a higher education institution across two separate 1st year undergraduate sport student cohorts, COPDMS was found to facilitate an adaptive mentality towards the transition into HE (Evans et al., 2022). Future orientated strategies such as COPDMS appear to provide a novel opportunity for students to make deliberate efforts to reduce or prevent future stressors from occurring and negatively impacting them (Aspinwall & Taylor, 1997; Evans et al., 2018). Specifically, Evans and colleagues (2022) found COPDMS significantly increased perceptions of social support and forms of group identification which are both considered key mechanisms for coping with major life transitions (Halbesleben, 2006; Schlossberg, 1981) that can benefit academic, social, and emotional adjustment to HE (Pratt et al., 2000). Given the promising research findings of COPDMS (Evans et al., 2022) it would seem appropriate to further examine the efficacy of COPDMS among students transitioning into HE as such a social and reflective experience may help to stimulate an approach focus to academic studies which could subsequently benefit student experiences and welfare within, HE settings.

Moving on from social resources, TCTSA-R (Meijen et al., 2020) specifically aligns with psychological predisposing factors, namely rational and irrational beliefs (Ellis, 1994), and their impact on challenge and threat responses under pressure. While cognitive appraisals take place and are influenced by the social environment they occur in (Lazarus, 1991), they are also impacted by deeply held personal beliefs (a cognitive construct) that may be either debilitative or facilitative to wellbeing and performance (Ellis, 1957). Irrational beliefs in the context of higher education, may take the form of beliefs about one's overall intelligence or ability to succeed in academia based on limited performance information, for example, 'If I fail this assignment, therefore I am a failure/stupid'. The next section will present an overview of irrational beliefs and their impact on wellbeing and performance.

1.5.3. Cognitive predispositions to challenge and threat responses

Returning briefly to ancient Greek philosophy, Atticus (c.175AD) saw the act of facing and overcoming stressful life events to hold the potential to be adaptive and result in personal growth. Later both physiological and cognitive researchers found evidence of adaptation to stress, where the body and mind progressively can build up a physical (Dienstbier, 1989) and cognitive-behavioural resilience to stress (Ellis, 1957). The TCTSA-R (Meijen et al., 2020) suggests that a proactive approach to developing personal resources (self-efficacy, perceived and emotional control) via the strategic implementation of psychological skills training such as goal setting, imagery, self-talk, and concentration (Andersen, 2009) can have a positive impact on situational resource appraisals. One approach in particular has been highlighted for its overlap with demands and resources, and the proactive reappraisal of adversity as it leads to growth and goal attainment. Namely rational emotive behaviour therapy (REBT) theory, which postulates that rational (RBs) and irrational beliefs (IBs) are fundamental cognitions that determine psychological wellbeing (Ellis, 1957). More specifically, IBs play a key role in determining affective states, especially prior to a motivated performance (Chadha et al., 2019).

REBT (Ellis, 1957; 1962) was conceived as a present-focused exploration of the cognitive construct, irrational beliefs (iBs) and the related emotional and behavioural consequences. Rational psychotherapy (Ellis, 1957), as it was termed in its inception, hypothesises that human emotion is the result of thinking (i.e., cognition). It was developed as a way of understanding human function and disfunction by an examination of personally held core beliefs about the demands of adversity (e.g., failure, loss, rejection), self/other-evaluative beliefs (e.g., self/other-worth, ability), evaluation of consequences (e.g., undesirable outcomes) and one's ability to cope emotionally (e.g., tolerance for discomfort). Irrational as opposed to rational beliefs are dogmatic, rigid cognitions, inconsistent with social reality and often hinder long-term goal attainment and psychological wellbeing (Wood et al., 2017).

IBs are summarised as four core beliefs, one primary (demandingness) and three secondary (self/other/life depreciation, awfulizing and discomfort/frustration intolerance; Ellis, 1962).

Demandingness, the primary irrational belief (IB) is an exaggerated preference for circumstances to be exactly as desired (Ellis, 1962; Ellis & Dryden, 2007). Often accompanied by rigid language, such as ‘must’, ‘have to’, ought’, etc., these beliefs tend to be problematic due to their inflexible nature, inconsistency with reality and interference with the pursuit of goals and values (Bennett & Turner, 2018). For example, a student may believe that they absolutely must achieve a perfect score on their examination. While this is likely to increase their motivation to prepare and do well, it also is likely to add unhelpful pressure to their exam day, potentially hindering their ability to fulfil their potential.

Awfulizing, a secondary IB, is the process of evaluating a situation/outcome as the worst possible event. This catastrophic interpretation is often the result of a rigid belief that an occurrence is 101% bad (Dryden, 2008). In contrast, a realistic evaluation of a situation, i.e., anti-awfulizing (Bennett & Turner, 2018), operates under the assumption that the outcome/situation may not be desirable but avoids catastrophic interpretations. Similarly, frustration/discomfort intolerance, also referred to as low frustration tolerance is the belief that one is incapable of tolerating the adverse conditions of a situation. For example, if a runner tells themselves ‘I can’t stand the fatigue’ during a high intensity run, this extreme belief is likely to hinder their ability to complete their run. Low frustration tolerance beliefs are likely to be unhelpful towards goal achievement as they exaggerate the discomfort a person naturally feels while pursuing goals (Bennett & Turner, 2018). In contrast, high frustration tolerance tends to evoke a response of recognition for difficulty, discomfort, etc, and a belief that one is able to tolerate it in service of what is important and meaningful to them (Oltean & David, 2017).

Finally, depreciation of self, other, world, are distinctly negative evaluations applied to either one-self, other people, situational conditions or life in general. These are often accompanied by attribution of blame and

generalisation of the negative/adverse aspect of a situation to what is being depreciated (e.g., ‘I failed, therefore I am a failure’). Such evaluations are often problematic, as they prevent one from actively coping with adversity. In contrast, unconditional acceptance of the negative aspects of a situation, can be rational and helpful in moving on from adversity. For example, in the context of academic examinations, ‘I failed’ may be accompanied by an admission of fallibility, ‘I am a fallible human being’, and leave room for moving forward, ‘my preparation has not been sufficient this time, I can prepare better next time’.

David and Cramer (2009) argue that our existing knowledge and beliefs influence situational evaluations (appraisals). While early psychology work linked existing knowledge to situational emotional responses (Schachter & Singer, 1962; Weiner, 1985), later developments have found little evidence in support. Instead, only salient knowledge or beliefs contribute to situational appraisals and the resulting emotional activation (David & Cramer, 2009; Lazarus, 1991). The cognitive theory of emotion (a.k.a. REBT theory) posits that during activating events, our beliefs can influence situational appraisals, psychophysiological arousal, and responses. Specifically, rational beliefs made salient during an activation event can result in functional psychophysiological emotional responses and adaptive behaviours, while irrational beliefs made salient during an activation event can result in dysfunctional psychophysiological emotional responses and maladaptive behaviours (Ellis & Harper, 1969).

Ellis and Harper (1975) suggested that the intensity of situational activation determines the different beliefs applied to the activation event and the related response. In other words, some activation (negative emotions or stress) is normal and adaptive, while overactivation (extreme negative emotions or stress) corresponds to clinical conditions. On the other hand, a complete lack of activation (non-response) represents a lack of motivation and can also disrupt coping efficiency (Yerkes and Dodson, 1908).

Albert Ellis described psychophysiological emotion as “a biased, prejudiced, or strongly evaluative kind-of thinking”, and thinking/cognition as the

relatively “calm and dispassionate appraisal (or organised perception) of a situation” (Ellis, 1956, p. 1). The former representing an inflexible, irrational, often exaggerated and adverse response, and the latter an objective, rational, balanced response. For example, in the context of the present thesis, a student delivering an oral presentation may experience arousal/stress and respond by feeling physically sick, unable to recall information, unable to meet their goal of completing the assignment (performance consequence; in line with a threat response), maybe experience anxiety in the future about failing (wellbeing consequence). Or, they may respond by noticing the arousal/stress, appraise it as energising/facilitative, perform in line with their potential, feel positive (in line with a challenge response).

Ellis’ theorising and work it the realm of emotion and cognition was directed at the applied, therapeutic impacts of working with individuals on their thinking as a way to influence emotional and behavioural responses. Ellis (1994) developed the GABC framework for understanding and treating disturbance. According to this framework individual goals, values and desires one has (G), are thwarted/obstructed by the present situation/adversity (A), and as a result unhealthy or unhelpful emotional and behavioural consequences (C) are triggered, based on the irrational beliefs (B) one uses to appraise the situation/adversity (A). Rational beliefs (B) about a situation/adversity (A) are likely to lead to healthy emotional activation and adaptive behaviours. Whereas irrational beliefs (IBs) about A are likely to evoke an unhealthy emotional activation and maladaptive behaviours. For example, the demand and resource appraisals of a student taking an exam (motivated performance, high in goal relevance; G), may be influenced by previous experiences of exam taking (A) that may have shaped their beliefs (e.g., “I have to get a perfect grade, otherwise I am a failure”; B) and experience an unhelpful response (e.g., test anxiety) and a disrupted exam performance (Putwain et al., 2010; Turner et al., 2024). Thus, beliefs play a key role in the appraisal process and how one responds (challenge /threat) to activating events (motivated performance).

1.5.4. Impact of irrational beliefs on challenge and threat states

Although directed at wellbeing as opposed to performance, the cognitive theory of irrational beliefs (Ellis, 1994) shares several key elements with cognitive appraisal theory (Lazarus & Folkman, 1984), especially in coping responses. First, both theories offer dual frameworks for how humans respond during stress and/or adversity, where a functional response is characterised by applying rational thinking and active coping. In contrast a dysfunctional response is characterised by applying irrational thinking and avoidance behaviour. Second, both frameworks highlight a two stage cognitive evaluation process, a primary and secondary stage impacting emotional and behavioural responses. Researchers are beginning to explore this overlap and the role of rational and irrational beliefs as they apply to challenge and threat responses, and the resultant performance and wellbeing consequences (David et al., 2002; Chadha et al., 2019; Mansel & Turner, 2022; Meijen et al., 2020).

Distinctly, Ellis (1994) suggested that IBs are most influential under conditions of real-life stressful situations (high arousal; Lazarus 1991). While this may present a limitation to testing the validity of the role of IBs during potentially stressful events, a meta-analysis by Visla et al. (2016) have demonstrated empirical support for the stronger relationship between IBs and experiences of dysfunctional stress during real life stressful events. Findings indicate that IBs have a stronger relationship with negative emotional responses (e.g., anxiety) and poor emotional wellbeing indicators (e.g., depression) in close temporal proximity to a stressful event and when the stressful event was one of personal importance. Also, IBs were found to correlate with elevated anxiety levels when performing under high pressure (Mesagno et al., 2021).

While in sport, challenge and threat theory and IBs are often considered for their impact on skill performance (Chadha et al., 2019; Turner, 2016) REBT literature is also heavily focused on the wellbeing impact of facing high pressure (i.e., potentially stressful) situations, such as academic stress

(Banks, 2011). A study by Chadha et al. (2019) suggests that individuals often adopt irrational beliefs in performance situations, especially ones of high personal importance such as a motivated performance. Findings reveal an interaction between cognitive appraisals, IBs, and challenge and threats states, in predicting affective states (positive emotions and somatic anxiety). More specifically, a threat state shares a positive association with IBs and a negative association with facilitative cognitive appraisals. A challenge state was found to positively associate with positive emotions and facilitative interpretations of anxiety. Thus, high IBs and low facilitative cognitive appraisals were found to increase the likelihood of a threat state occurring prior to performing under pressure (golf setting; Chadha et al., 2019). Additionally, a recent study by Everson and has demonstrated that irrational beliefs impact performance across domains. More specifically, they tested whether it was context-specific or general irrational beliefs that are predictive of student-athletes' performance in their academic and athletic domains. Their findings demonstrate a minor difference, suggesting that a tendency to hold IBs, especially demandingness (e.g., 'others must treat me fairly'; a primary irrational belief; Mansell & Turner, 2022) is likely to impact situational cognitions and performance.

Some initial correlational research in higher education suggests that IBs relate positively to academic motivation, but negatively to students' academic self-efficacy (Ozer & Akgun, 2015), suggesting a complex interplay of cognitive appraisals. The amalgamation of REBT theory and challenge and threat theory is advantageous within higher education for several reasons. Firstly, students are a key population used in psychology research with the goal of generalising to other populations. Higher education is one exemplary high-pressure environment which presents key opportunities for building coping skills, that can be utilised in future performance domains. Research utilising student populations would have high application utility to students in their present high-pressure environment (i.e., their studies) and could be used to improve students' capacity for coping with pressure (Dwyer & Cummings, 2001).

Second, deeply held beliefs are likely to have the greatest impact in relation to real-life stressors, compared to lab generated stressors. Thus, field based

research on academic stress experienced by students in higher education presents an opportunity to study the suggested links between REBT and TCTSA theories. This is especially relevant to the present body of research, as it seeks to examine the psychological wellbeing and capacity for coping of students in higher education. Third, applied research in REBT and TCTSA (e.g., Wood et al., 2017) has begun moving towards a psychophysiological approach to influencing performance under pressure and performer's psychological wellbeing. More specifically, irrational beliefs have been linked to debilitative emotional, cognitive and behavioural experiences, relating to poor psychological wellbeing (Jordana et al., 2020; David et al., 2017). Understanding the interplay of beliefs and responses under pressure, could open applied avenues for improving coping capacity of students for the duration of their academic experience and for facing future performance challenges later in life.

1.6. Summary

The TCTSA (Jones et al., 2009) and TCTSA-R (Meijen et al., 2020) have received research and application interest not only in athletic performance but across a broad spectrum of performance contexts (Hase et al., 2019). The differentiation between challenge and threat responding has expanded overall understanding of the human stress response from a biopsychosocial perspective, along with related interpersonal and intrapersonal predispositions, performance outcomes and wellbeing. Most importantly, this detailed examination of stress has paved the way for the development of effective interventions that hold potential for improving performance and psychological wellbeing. Whilst other related theoretical developments in challenge and threat research are available and have been considered (e.g., Uphill et al., 2019). This thesis will draw on the TCTSA and TCTSA-revised frameworks (Jones et al., 2009; Meijen et al., 2020) due to the broader outlook on challenge and threat states (i.e., inclusive of personal and social predispositions), which would lend itself best to the real-world setting and applied nature of this PhD project.

The final section of this chapter will review how the research proposed in this thesis seeks to apply TCTSA theory in a higher education setting.

1.7. Embedding TCTSA-R into the context of Higher education

1.7.1. Higher education, wellbeing and performance of students

Students' wellbeing and performance in Higher Education (HE) is beginning to receive increased attention from educational organisations and national governing bodies. Recognition of the stressors embedded within higher education has historically been under researched, with a few specific population exclusions such as health speciality degree students (Robotham, 2008; Robotham & Julian, 2006). A review of the stressors impacting students by Robotham and Julian (2006) highlights the key areas impacting students' experiences of stress within academia. Transitional, financial and examination stressors have been highlighted to impact students' experiences in HE. Among them specific factors such as being away from existing support networks, the need to coordinate and deliver on work and study commitments, and building and managing new social connections, have been highlighted to add to the perceived demands of academic pressures (Robotham, 2008). However, the way these potential stressors/demands are appraised in relation to students perceived coping resources (Lazarus, 1991) has been found to influence overall experiences of the academic journey (Ross et al., 1999).

In-line with competitive sport, HE can be a stressful environment (Pitt et al, 2018), where individual's future careers and wellbeing are often dependent on how well they handle stress and perform under pressure (Shu-Hui & Yun-Chen, 2014). In other words, a context where performance is personally meaningful and an individual is motivated to do well, facilitates one of two responses based on their appraisal of the situation (demands) and their coping potential (resources; Blascovich et al., 2004; Smith et al., 2022). Where the resources are appraised as sufficient to meet the demands of the performance domain, an individual is likely to approach the performance as a

challenge and respond optimally. Where the demands outweigh coping resources, an individual is likely to approach the performance as a threat and respond sub-optimally. Successfully coping with performance domains, like HE, can offer important wellbeing and developmental benefits (Stambulova & Wylleman, 2015). Existing empirical research offers some understanding of the stressors faced in HE (e.g., transitioning and building relationships; Evans et al., 2022), as well as the potential for personal growth and development that can result from learning to cope with these stressors (Robotham, 2008)

1.7.2. Theory of Challenge and Threat states in an academic setting

The Theory of Challenge and Threat States in athletes (Jones et al., 2009; Meijen et al., 2020), indicates that stressful life experiences are not necessarily detrimental to life/health and that how we perceive, approach, and appraise them can enable personal and social growth. In fact, two people performing the same skill (e.g., delivering a talk) in a high-pressure environment (e.g., to a group of peers), can have comparable knowledge and skill potential, but may yet perform very differently (e.g., studder). This is due, in part, to the way they perceive and experience stress in that high-pressure environment. In one case the stress is maladaptive and overwhelming, preventing the person coping and performing well, and in the other the stress is adaptive, activating and energising (Jones et al, 2009). Growing research into irrational beliefs (Chadha et al., 2019; Turner et al 2024), cognitive appraisals (situation evaluations; Lazarus & Folkman, 1984; Lazarus, 1991; Blascovich & Tomaka, 1996) and the resulting Challenge and Threat states (Blascovich & Mendes, 2000; Skinner & Brewer, 2002; Blascovich, 2008; Jones et al, 2009; Seery, 2011; Meijen et al, 2020) has found links between stress evaluations, coping resources, actual performance outcomes, and wellbeing.

As established earlier, even though TCTSA/TCTSA-R (Jones et al., 2009; Meijen et al., 2020) appear to specifically target athletic performance,

conceptually these have been evidenced to fit in a multitude of human performance settings. Successful applications in aviation (Vine et al., 2015), surgery (Moore et al., 2014), business (Slater et al., 2016), policing (Jones et al., 2020), firefighters (Wood et al., 2021), and academia (Evans et al., 2022; Seery et al., 2010), position challenge and threat conceptualisations as highly applicable in predicting human performance in general, and not only in athletic performance.

An adapted overview of TCTSA (Jones et al., 2009) incorporating social resources and psychological predispositions based on TCTSA-R (Meijen et al., 2020) is available in Figure 1.2. The current thesis considers higher education as a motivated performance context and is aligned with the central predictions of TCTSA (Jones et al., 2009), where students who are challenged are more likely to outperform students who are threatened. Challenged students would report high resource appraisals (self-efficacy, control and approach goals) and would present with an increase in CO and stable or decreased TPR, along with predominantly positive emotions) in relation to academic assessment performance. In contrast, threatened students would report lower resource appraisals (self-efficacy, control and approach goals) and present with an increase in TPR and stable or decreased CO, along with predominantly positive emotions) in relation to academic assessment performance. Additionally, psychological predispositions (irrational beliefs), and social resources (support and identity) are considered for their proposed influence and interaction with psychological resources on students' challenge/threat responses, performance (Meijen et al., 2020) and wellbeing (Blascovich & Mendes, 2000; Blascovich & Tomaka, 1996). Where the concept of wellbeing and its relationship to challenge and threat states has mostly been researched in BPSM driven research (e.g., McLoughlin et al., 2024), the current thesis will explore performance and wellbeing from a TCTSA/TCTSA-R (Jones et al., 2009; Meijen et al., 2020) conceptualisation.

While the BPSM and TCTSA theories target performance in settings outside of academia, these have extensively been developed with student participant populations. With few exclusions, student and student-athlete participant populations have been utilised to evidence the application of challenge and

threat theory in motor performance tasks (e.g., golf-putting; Moore et al., 2012), public speaking (Trotman et al., 2018), visual search tasks (Frings et al., 2014), word search tasks (Mendes et al., 2008) and others. Nevertheless, few studies actually utilise challenge and threat theory in an academic setting (e.g., Malkoc et al., 2023; Smith et al., 2022). When it comes to stress research targeting academic settings this has oriented around experiences of exam stress (Kange et al., 1996), test/examination anxiety (Cassady & Johnson, 2002; Zwettler et al., 2018;), approaches to learning and support availability (Biggs, 1987; Bliuc et al., 2011a). As such the present thesis will apply challenge and threat theory (TCTSA/TCTSA-R; Jones et al., 2009; Meijen et al., 2020) specifically to examine student performance and wellbeing from a biopsychosocial perspective. The three studies outlined in chapters two, three and four will seek to test the theoretical integration between psychophysiological and psychosocial responses to academic stressors and expand current understanding of student wellbeing and performance.

1.7.3. Psychophysiological response to academic stressors

Research from Cassady and Johnson (2002) offer a model for understanding anxiety and performance in an educational setting. They specifically identify a physiological arousal element ‘emotionality’ and a psychological arousal element ‘worry’ (appraisal based), and this arousal is the result of a Lazarutian interplay of task requirements (demands), and coping resources (specifically confidence and control over situational factors). As such, the work of Cassady and colleagues resemble closely BPSM and TCTSA theorising. Interestingly in a recent line of research, Cassady and colleagues (2024) have found evidence that low tolerance of uncertainty can be a predisposing factor to experiencing test anxiety, leading to poorer test performance. This inclusion of predisposing cognitive factors in models predicting performance is not unlike the inclusion of irrational beliefs (Chadha et al., 2019) into the TCTSA-R (Meijen et al., 2020). While the work of Cassady offers an alternative conceptualisation of academic performance, the TCTSA/TCTSAR benefits from more rigorous evidence base and a

clearer distinction between factors impacting performance and is thus the conceptualisation applied to this PhD project. Nevertheless, Cassady's work is clear evidence of the applicability of Lazarutian performance based conceptualisation of human performance under pressure/stress.

Physiological responses to stress were also reviewed by Segerstrom and Miller (2004) in a meta-analysis of the impact of stress on the human immunological response which concluded that humans could respond to acute stressors with an exaggerated and sometimes continued immunosuppressive response. For example, Kang et al. (1996) found evidence that the stress of academic examinations impacted both healthy and asthmatic participants, through a brief reduction in lung function and an altered immune response. In a later study, significant immune system suppression was identified in response to academic examination stress, which then proceeded to subside in the post examination period (Kang et al., 1997). However, Kang et al. (1997) also identified that some participants experienced a prolonged phase of their inflammatory cell activation, suggesting a delayed subsidence of the stress response and a long-term impact of stress on the body.

A clearer psychophysiological view of arousal as applied to academic stressors, however, came a bit later in a study by Seery et al. (2010). Seery and colleagues (2010) were not the first to test challenge and threat theory within academia but were one of few studies to actually consider academia as a motivated performance domain to which challenge and threat theory could be applied. They measured students' previous academic scores (SAT scores), academic self-efficacy, course scores, and CVR indices while delivering two speeches, one on academic interests and one on taking tests. They found that challenge and threat responses (as indicated by CO and TPR) to the academic interests talks, explained significant variance in course scores, beyond what was explained by SAT scores and self-efficacy. Interestingly responses to the test taking talks failed to predict course scores and Seery et al. (2010), interpreted their findings to be evidence that academic success may be more reliably predicted by challenge and threat states in the presence of identification and evaluation of personal interests.

This could be interpreted as an indication of motivational state and choice autonomy, i.e. a motivated performance.

Some mixed evidence of the application of TCTSA (Jones et al., 2009) with HE students was presented by Smith and colleagues (2022) when they tested students' stress response to a speech in an academic setting. The study successfully evoked challenge and threat responses in students, by asking them to prepare and deliver a speech on an academic topic. Their results however found no significant evidence that self-efficacy and control (perceived resources) predict challenge and threat states. Also, challenge and threat responses related to the academic speech task did not predict the academic performance of the 36 undergraduate students tested. While the findings lack support for the application of TCTSA in an academic setting there are several methodological and analysis limitations to bear in mind. Firstly, self-efficacy and control measures (proposed antecedents) were taken following measures of challenge and threat, as antecedents it would follow that these measures are taken prior to measuring cardiovascular stress responses. Second, incomplete measures of cognitive appraisal were taken during data collection, for example only 2 of the 3 resource appraisals were measured. Third, as participants did not actually deliver the talks they were preparing while physiological stress responses were measured. It is possible that participants taking part first may have shared with others participating later that no speech is delivered thus influencing responses of the group. Forth, the study failed to report statistical results such as ANOVA statistics, effect sizes or observed power. Finally, due to sample size and lack of control group comparison, the study's findings are hard to generalise in the face of other research that support the theory's applicability in performance populations (e.g., Blascovich et al., 2004, Seery et al., 2010).

In comparison, Ringeisen et al., (2019) studied the interplay between self-efficacy, threat appraisals, anxiety, salivatory cortisol concentrations (indicator of challenge/threat responding) and academic performance in a real-life examination in higher education. They measured cortisol and anxiety three times throughout the exam day (30min prior exam, straight after exam and straight after grades release) and once on a 'control day (1 week before examinations). Firstly, they found that demographic variables played a

significant role in determining anxiety and cortisol levels in participants on the day of the exam but not a week before. Emphasising the importance of psychological resources measuring stress in close temporal proximity to the stressor and the acute nature of the stress responses to performance under pressure, similar to that seen in research with athletic performances. Second, self-efficacy from a week prior to exams, was found to indirectly predict stress appraisals and anxiety levels. Thus, psychological resource appraisals may be influenced by predisposing beliefs (Meijen et al., 2020). Third, self-reported anxiety levels demonstrated less variability than concentrations of cortisol, indication that the concentration of cortisol may be a more reliable measure of individual differences in stress responding. However, grades (i.e., performance) were uncorrelated to levels of cortisol and were instead corelated with self-reported anxiety, indicating the performance predictive power of appraisals, compared to physiology. Forth, their latent growth modelling results align with a transactional model of responding to psychophysiological stress/arousal (Smith & Lazarus, 1993). More specifically, activation was higher on the day of performance, in comparison to a week earlier, and decreased gradually after examinations and receipt of grades. Finally, Ringeisen et al. (2019) interpreted their data to exemplify that higher levels of activation (threat appraisals), combined with an efficient recovery, to relate to better performance on academic examination. Emphasising, the importance of coping efficiency under pressure for performance, i.e., fulfilling performance potential (Meijen et al., 2020). While Ringeisen et al. (2019) does have several limitations, starting from the use of hormonal indicators which can be unreliable, yielding different results depending on study design (Campbell & Ehlert, 2012; Ringeisen et al., 2019). Also, limitations related to field-based research and quasi-experimental designs mean that contextual factors, e.g., type of task, audience expertise level may should be considered in the interpretation of these findings (Ringeisen et al., 2019). Nevertheless, the research brings together key elements of challenge and threat theory, expanding toward a holistic understanding of performing under pressure as a psychophysiological phenomenon.

Finally, a recent study by Malkoc and colleagues (2023), offers insight into the challenge and threat antecedents to academic performance. They tested 427 Austian university students' challenge and threat appraisals, positive and negative affect as it related to academic achievement and academic performance (points awarded on final course exam).

Their findings suggest that challenge and threat appraisals play a key role in students' emotional response, where negative emotions were found to play an important role, negatively influencing academic performance (20% variance explained). Despite the inherent limitations of cross-sectional research, this study benefits from a large sample size and rigours analytic methods. Additionally, this study utilised a BPSM (Blascovich and Tomaka, 1996) approach to challenge and threat and did not explore the universal resource appraisal antecedents suggested by TCTSA (Jones et al., 2009), the influence of which will be considered in this thesis and the three studies.

1.7.4. Psychosocial responses to academic stressors

A body of research from Australia has highlighted the important links between student wellbeing and performance, drawing important links between perceptions of social support, emotional responses, and successful transitions into academia. For example, Zimmerman et al. (2019) researched how university support services can play an important role in students developing the appropriate coping skills during their initial transition into academia. Interestingly, two of the five key coping skills suggested by the Five senses of Success Framework (Lizzio, 2006) are social skills, connection and identity. Zimmerman et al. (2019) identified that fostering a supportive culture during the transition and integration of nursing students into their course was a key influential factor for student retention and academic success.

Relevant examples from the field of personality research, Perera and DiGiacomo (2015) found that trait emotional intelligence, a personality concept which encompasses elements of self-driven motivation and a disposition for self-controlled behaviour, have the potential to foster effective coping during transitions. In an academic setting, students with higher

emotional trait intelligence displayed positive academic adjustment (organisation and attention to studies) and academic performance (first semester grades) and this link was mediated by active coping and higher perceptions of social support availability (Perera & DiGiacomo, 2015). Similarly, perceptions of stress and social support were found to mediate the relationship between emotional intelligence and reported wellbeing in male athletes (Malinauskas & Malinauskienė, 2018). While these studies orient around personality concepts and less on the acute response to performing under pressure, they further emphasise the importance of psychological and social resources in performance contexts. Elements such as motivation, self-control, and social connectedness and support availability perceptions, come up across the literature as key ingredients to performing in domains of high personal importance as well as experiencing a sense of psychological wellbeing.

Research in social facilitation of transitions such as academia, has been successful in evidencing the positive impact of social connectedness and support availability. Chow (2007) suggested that high quality social connections in an academic environment can have a protective quality against the experience of academic stress and aid in reports of psychological wellbeing. Later, Chow (2010) went on to study the specific areas of individual student's life that relate to higher reported wellbeing and academic achievement. Findings highlight the importance of physical health, self-confidence, strength of social relationships, familial history of academic success, all relate to higher reports of psychological wellbeing and academic achievement. Similarly, Bliuc and colleagues (2011) found that, students' social identification indirectly predicts academic achievement via approaches to learning. More specifically a student who has a stronger social identification with their student group are more likely to adopt a deep approach to learning and achieve better in their academic studies. On the other side, a weaker student identification is likely to predict poorer academic achievement via a shallow approach to learning (Bliuc et al., 2011). Finally, Zwettler and colleagues (2018) found that a strong student identity can have a protective quality against experiencing test anxiety.

A more intervention oriented approach however is presented in the work of Evans and colleagues. Evans et al. (2022) wanted to help students manage the stress related to higher education by boosting students' perceptions of resource availability during their transition into academia. They wanted to make salient students' confidence and existing coping resources while boosting students' sense of social connectedness. To achieve this, a single coping oriented personal disclosure mutual sharing (COPDMS; Evans et al., 2018) session was delivered with students in their introductory week. As a result, participants reported several positive stress-buffering impacts, including increased confidence, connectedness and perceived availability of support (Evans et al., 2022). Whilst some of the findings offer mixed evidence on student learning efficacy, there were indications of a single COPDMS session having an acute impact on students' experience of relationships within their group.

1.8. The present research: A biopsychosocial examination of psychological wellbeing and performance in higher education

This thesis addresses the presentation of challenge and threat states and cognitive appraisals in the context of academic performance and wellbeing of higher education students. Additionally, it integrates the influence of predisposing beliefs (irrational beliefs) and social factors (support and identity). The three empirical studies especially focus on real-life stress of academia, and as such, it follows that we consider not only the established introduction of social factors into challenge and threat theory, but also take into consideration the impact of IBs in determining students' predisposing beliefs about academic stress and performing in academia. In doing so, this thesis adopts well-established theory for formulating and testing hypotheses about human performance under pressure and its relation to wellbeing. This line of enquiry emphasises the importance of psychophysiological (cognitive appraisals, IBs and cardiovascular arousal) and psychosocial (appraisal of

social connectedness and availability of support) processes in the process of performing under pressure by incorporating biopsychosocial predispositions, situational cognitive appraisals and a dynamic reappraisal process. The result of which determines the likelihood that an individual may fulfil their potential in a given performance, in this case academic achievement. As well as, facilitated wellbeing through an overall facilitative/healthy appraisal of experiences (Ellis, 1994).

1.8.1. Studies in this project/PhD thesis

This programme of research is grounded in a holistic biopsychosocial approach to understanding, and positively impacting, the performance and wellbeing of students in higher education. The current research represents the next steps in a theoretical integration, suggested and supported by over 65 years of research, and its applied application to the wellbeing and performance of students in higher education.

Looking back at the historical development of Challenge and Threat appraisals and responses to stressful or high pressure situations, the work of Blascovich and colleagues (Blascovich & Tomaka, 1996; Blascovich & Mendez, 2000; Mendez et al., 2001) based on the earlier work of Lazarus (1981,1984) on the appraisal process, found a strong relationship between a person's cognitive interpretation and their physiological response to stress/pressure. Their work, known as the biopsychosocial model (BPSM; Blascovich & Tomaka, 1996) of arousal regulation, was later applied and developed into the Theory of Challenge and Threat in Athletes (TCTSA; Jones et al., 2009), which has been applied in performance psychology research successfully in evidencing the positive impact on performance, of a Challenge (as opposed to a Threat) response under pressure, with research making additional references to the potential benefits to wellbeing (TCTSA Revised; Meijen et al., 2020). Examples can be seen in a number of high-performance environments, such as aviation (Vine et al., 2015), surgery

(Moore et al., 2014), , change management in business (Slater et al., 2016), and public speaking tasks (Trotman et al., 2018).

In the latest iterations of Challenge and Threat concepts, it has been suggested to expand beyond a psychophysiological framework of performance under pressure, to include the impact of social factors (e.g., Bianco & Eklund, 2001; Freeman & Rees, 2010; Miller et al., 2021; Slater et al., 2018) and individual predispositions such as beliefs (e.g., David et al., 2002; Chadha et al., 2019; Dixon et al., 2017; Evans et al., 2018). This suggestion implies a theoretical incorporation of TCTSA, Social Identity Theory (Tajfel & Turner, 1979) and Rational Emotive Behavioural Therapy (REBT; Ellis, 1957). This holistic perspective to human performance under pressure and the potential benefits to wellbeing, of a Challenge response form the theoretical grounds for this PhD research and thesis. As such, this project represents an effort towards achieving the above theoretical integration and applying it to the performance field of higher education. The proposed theoretical integration provides evidence-based interventions that can be applied within higher education to positively impact the wellbeing and performance of students. More specifically, study three (chapter 4) in this PhD examines one such intervention, namely Coping Oriented Personal Disclosure Mutual Sharing intervention (COPDMS; Evans et al., 2019), judged to be applicable and scalable within higher education.

There are at least three unique selling points of this project/PhD work, the first of which is the above described theoretical integration and contribution to the research evidence base from data across three empirical studies. Second, the first two empirical studies apply the suggested biopsychosocial approach directly to student performance and wellbeing on two levels. Study one (chapter 2) applies a biopsychosocial approach on a macro level, to investigate student wellbeing and performance (whole university approach), from a longitudinal view, across the span of a full academic year (start, mid-point, and end of academic year). The study measures students' challenge and threat appraisals, beliefs, social belonging and support availability, and links these to their reported wellbeing and academic performance

predictions. Building on study one, the second study (chapter 3) applies the same biopsychosocial approach on a micro level, taking the same measurements as study one, in relation to a specific real life presentation assessment for a cohort of university students. Furthermore, study two builds on the first through the addition of measuring students' cardiovascular responses to stress ahead (within 90 minutes) of their presentation assessment. This specific part of study two data collection methodology has been applied (e.g., Turner et al., 2013), but never within such close temporal proximity to the stressful event itself in a student population, in this, study two is unique in taking on the related challenges. Notably applying a biopsychosocial perspective on both levels (whole university and specific cohort/assessment) will allow for better understanding of the mechanisms behind student performance and wellbeing in HE.

Third, the application of the biopsychosocial approach (based on studies one and two) to examine the impact of a wellbeing intervention, applied with three cohorts of students (1 pilot and 2 main research groups). Study three builds on studies one and two in four ways: (1) collaborating across two HE institutions to pilot test the study during their earlier start to the academic year; (2) employing an intervention and control group method; (3) expanding the literature base about not only the theoretical models in the project, but the research in the specific intervention, namely COPDMS; (4) this line of research contributes to the practical application of wellbeing interventions that are scalable and fit within an overall academic curriculum. Whilst all four points represent key contributions to research and applied practice, the final point (4) may be the most important as it holds potential to inform and change the practical delivery of academic teaching in a manner that can promote student wellbeing and performance. The COPDMS intervention chosen to be tested in this study requires minimal specialist involvement. In other words, academics can be trained to deliver it, it fits into a course curriculum as part of welcome activities, and as such is scalable to an entire university with minimal investment and disruption to academic teaching.

1.8.2. Thesis Aims

1) To test the theoretical integration of social resources (perceived social support availability and social identity) and cognitive predispositions (irrational beliefs) into the TCTSA (a biopsychosocial approach), by testing the influence on resource appraisals and cardiovascular indices of challenge and threat (Chapter 3, three and four)
2) To test the applicability of a biopsychosocial approach to performance and wellbeing in higher education students (chapters two and three).
3) To evaluate a COPDMS intervention from a biopsychosocial perspective. (Chapter 5).

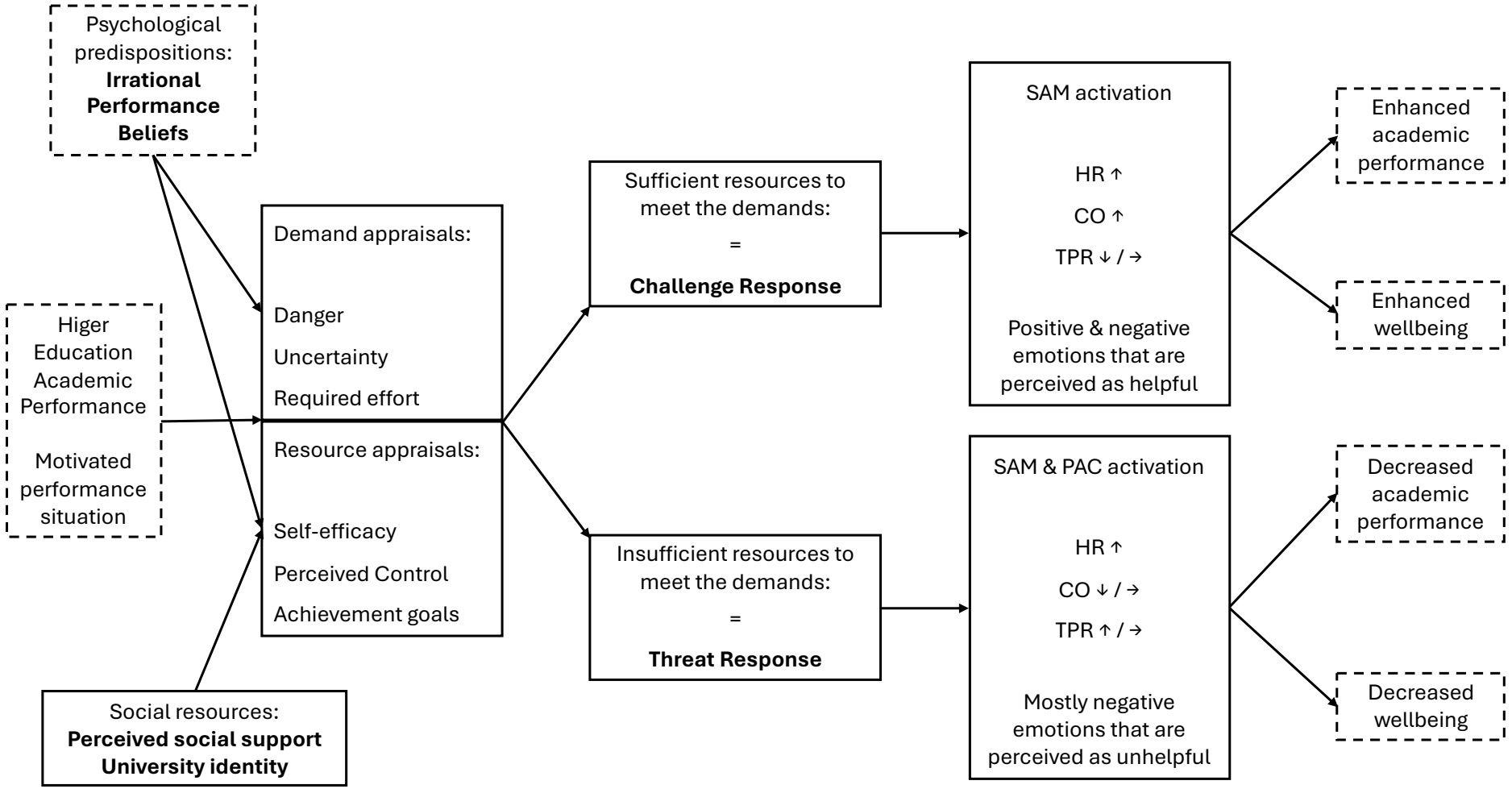


Figure 1.2 Theoretical framework - An adapted overview of TCTSA (Jones et al., 2009) incorporating social resources and psychological predispositions based on TCTSA-R (Meijen et al., 2020). Boxes with dotted lines represent how this thesis proposes to extend current theory. Note: SAM = sympathetic-adrenomedullary, PAC = pituitary-adreno-cortical, CO= cardiac output, TPR = total peripheral resistance, HR = heart rate, ↑ = increase, ↓ = decrease, → = stable.

Chapter 2. Methodology

2.1 Introduction

Chapter one outlined the theory and research on psychophysiological challenge and threat responses, alongside the influence of social and cognitive predispositions, as suggested by recent theoretical developments (Meijen et al., 2020). The narrative outlined the roles of appraisals and predispositions as antecedents to challenge and threat responses, as well as to wellbeing and performance in motivated performance situations. In light of the presented research and theory, this thesis combines three key aims.

First, to quantitatively evaluate the suggested theorised integration of social resources and cognitive predispositions into a biopsychosocial theory of wellbeing and performance under pressure based on the TCTSA-R (Meijen et al., 2020). Second, to test the applied impact of the integrated biopsychosocial TCTSA on student performance and wellbeing. Third, to apply a biopsychosocial evaluation of a theory-aligned intervention (COPDMS; Evans et al., 2022) and its impact on student wellbeing. By adopting these three aims, this thesis bridges the gap between biopsychosocial stress, performance, and wellbeing theory and real-world application within the high-performance environment of higher education.

Whilst chapters 3, 4, and 5 of this thesis will describe in detail the methodology and analysis strategies of each of the three studies, it is pertinent to understand the underlying ontological and epistemological perspectives that these methodological choices represent. Crotty (1998) suggests a simple framework for ensuring coherence among research stance (ontology and epistemology), theoretical perspective, methodology and methods.

This chapter will set out the objectivist epistemological foundations of this body of research, as well as the relevant beliefs that inform the research methodology applied in each of the three studies. These foundations lead to a post-positivist theoretical perspective and to subsequent survey-based, experimental, and exploratory methodologies. The quantitative three-study design utilises sampling, psychometric questionnaires, cardiovascular measures of theorised stress indicators and a social validation survey. These quantitative methods serve to test the proposed theoretical integration, evaluate cardiovascular responses to academic stressors, and evaluate biopsychosocial responses to a theoretically aligned psycho-social intervention.

2.2 Ontology, epistemology and research design

2.2.1 Ontological assumptions: Biopsychosocial reality

Because of the Biopsychosocial nature of this research, both general ontology (Snape & Spencer, 2003) and social ontology (Bryman, 2008) are relevant considerations. General ontology, as it pertains to the nature of reality and our ability to study it (Crotty, 1998), is applicable here. The psycho-physiological activation in response to environmental changes has historically been studied through the scientific method and, as discussed in chapter 1, aligns closely with the study of objective, observable reality. More specifically, this thesis examines theorised manifestations of physiological stress and objective performance, alongside the measurable psychological constructs theorised to contribute to these outcomes. Separately, social ontology is also relevant, as the research concerns social entities such as social identity and perceived social support, which exist through social relations and shared meanings.

As such, the underlying ontological position of this thesis is that objective reality exists and that it can, at least in part, be measured and modelled, even when it is manifested in complex biopsychosocial processes. At the same time, these processes are embedded in social contexts and subjective experiences, and our access to them is always partial and mediated.

Student wellbeing and academic stress are key concepts of examination for their impact on universities' success as organisations. These key factors are addressed through existing services (e.g., student support) to improve student outcomes and organisational profitability. It is essential to evaluate the role of these universally valued concepts. This realist/social-ontological stance can be applied within the higher-education context to uncover the presentation of stress, wellbeing and psycho-social resources in students' academic performance. Furthermore, the direct application of existing biopsychosocial theory offers an opportunity to study and refine how student wellbeing and academic stress are addressed.

While the alternative subjectivist paradigm would also be applicable to the study of student wellbeing and academic stress. Indeed, approaching the concepts under investigation through the rich experience constructed within the individuals' consciousness would add to the research base. To this end, some subjective data are captured through open social validation questions (Chapter 5). However, the key aim of this thesis is to translate research into practical, general applications in the high-performance environment of higher education. Hence, an objectivist stance is maintained throughout the three studies and aligns with the stated aims of this thesis.

2.2.2 Epistemological stance: Post-positivist realism

The epistemological assumptions underpinning this thesis are grounded in an objectivist tradition, reflected in a broadly positivist approach to the generation and evaluation of knowledge. However, to characterise the researcher's philosophy as purely positivist would be inaccurate. Even in carefully controlled research, knowledge production is shaped by researchers' decisions, interpretations, and backgrounds, particularly in naturalistic contexts where researchers have direct contact with participants.

The researcher's epistemological and ontological assumptions, therefore, shape the approach to the world and its phenomena and inform understanding of biopsychosocial research more generally, as well as the specific methodology and methods adopted in this thesis. These positions have developed from the researcher's early engagement with the natural sciences (biology, chemistry, and physics) and their later application (e.g., in this body of research) to human psychology. They are also influenced by reflections on the researcher's personal strengths and limitations, as well as a pragmatic concern with using existing strengths and available methods to advance knowledge.

The researcher's epistemological stance is grounded in the belief that there is an absolute reality, but that human ability to observe it is constrained by our capacity to measure and interpret it. The researcher believes that human beings, shaped by genetic predispositions, lived experiences, and personal interests, are incapable of complete objectivity. As such, even the most rigorous attempts at objectivism are unavoidably coloured by interpretive processes and contextual constraints (Bronowski, 1956; Clark, 1998; Schumacher & Gortner, 1992). Nevertheless, research aims to uncover the unknown, and researchers must apply their strengths as best they can to study objective reality and the different ways in which it is interpreted. From this perspective, it is both necessary and appropriate to draw on multiple epistemological tools and to test the validity of our approaches against the best available evidence (Clark, 1998).

Taken together, these commitments align with a post-positivist realism perspective in which quantitative methods, statistical inference, and standardised measures are used to approximate an underlying reality, while explicitly recognising measurement error, contextual influences, and the role of researcher bias (Schumacher & Gortner, 1992). Within this stance, multiple studies, replication, and converging indicators are treated as key routes to strengthening knowledge claims, under contextual constraints (Schumacher & Gortner, 1992).

Within this post-positivist realism stance, the researcher adopts a quantitative approach to model and test associations between

biopsychosocial variables and student outcomes over time and across contexts. The overall approach assumes that underlying processes related to stress, wellbeing, and performance exist and can be approximated through carefully designed measurement, while recognising that such measurement is necessarily partial and subject to interpretive judgement Bronowski, 1956).

Across all three empirical studies, the thesis remains within a single quantitative paradigm rather than mixing paradigms. Longitudinal, quasi-experimental, and exploratory intervention designs are used as different methodological instantiations of the same post-positivist realism stance of hypothesis-testing, estimation, and model comparison.

2.3 Overview of the three empirical studies

2.3.1 Study 1: Longitudinal survey design

Study 1 in Chapter 3 employs a longitudinal, repeated-measures survey design to examine changes in student wellbeing and predicted academic performance over one academic year. Data were collected at three time points, enabling repeated modelling of the interaction between the theorised psycho-social variables across the academic year. These methodological decisions were driven by the first and second aims of the thesis: theoretical integration and applicability to the context of higher education, more specifically to student wellbeing and predicted academic performance.

Existing research supports the cross-sectional presentation of challenge and threat states in motivated performance contexts beyond competitive sports, as well as the theorised links to social and cognitive factors (Meijen et al., 2020). This study makes an original contribution to the literature by responding to the call to integrate challenge and threat responses with social and cognitive phenomena. Hence, all aspects of the theoretical integration are incorporated, measured, and analysed. As such, Study 1 (Chapter 3) captured data on challenge and threat appraisals (demands and resources), social identity and support, and cognitive predispositions (rational and irrational beliefs).

Furthermore, the goal for extending the evidence base beyond cross-sectional research was a key driver for the longitudinal approach adopted in this study. The three-time-point approach across the academic year goes a step beyond baseline and follow-up data, offering a more detailed overview of how variables change over the academic year. Whilst the addition of a fourth time-point and expanding the research beyond one academic year were considered, these options were omitted due to practical limitations, including time, resource availability, and statistical power considerations.

Lastly, in alignment with the second aim of the thesis, the study methodology was adapted to meet the demands of naturalistic research. As such, survey-based measurement of student wellbeing and predicted performance as they occur naturally for higher education students was measured.

Hierarchical multiple regressions were used to examine cross-sectional predictors of wellbeing and predicted performance at each time point. As such, they represent the first step towards testing and retesting the cross-sectional suggested theoretical integration. Building on the cross-sectional evidence, fixed-effects repeated-measures regressions assessed the stability of these predictors over time. The fixed-effects approach was selected over alternative temporal modelling approaches (e.g., Chadha et al., 2023) because it aligns with the sample size and number of variables included in the theoretical integration.

Lastly, exploratory repeated-measures ANOVAs/MANOVAs examined temporal change in wellbeing, predicted performance, resource appraisals, social identity, social support, and irrational beliefs. These exploratory analyses utilised the available data for each variable at the three time points independently. Observing changes or stability in each variable over time is utilised to extend the knowledge base for each variable and the evidence-based methodology used to measure it.

In summary, modelling the theorised predictors of wellbeing and predicted performance at each time point and across time points addressed the first and second aims of this thesis. Additionally, the temporal models examining changes in each variable over time were a novel approach to studying the stability of the measured variables and their distribution in the HE student population. More specifically, the temporal models revealed changes in variables measured at the trait level and stability in variables measured at the state level, with implications for applied practice. Detailed results, discussion and limitations are presented in Chapter 3.

2.3.2 Study 2: Quasi-experimental psychophysiological study

Study 2 in Chapter 4 employs a quasi-experimental, field-based design around a real graded presentation assessment to investigate the biopsychosocial antecedents of challenge/threat responses, wellbeing, and performance. Students completed self-report measures and underwent laboratory-based measurement of cardiovascular reactivity to the assessment instructions using Portapres® technology. Finally, students' academic board-confirmed grades for the assessment were obtained.

Several methodological changes from study 1 to study 2 were made in response to the adopted perspective in study 2 (cohort-focused) and lessons

learned from the data collection phase of study 1. Important considerations were addressing the first and second aims of the thesis from the perspective of academic assessment and performance; changes to survey selection; and the addition of cardiovascular data.

Firstly, where study 1 adopts a university-wide perspective, study 2 adopts a cohort perspective on the suggested theoretical integration and application to student wellbeing and predicted performance. The smaller sample size in study 2 presents an opportunity to adopt an experimental, lab-based approach. As such, this study contributes to the literature by adding objective measures of cardiovascular challenge and threat, as well as academic assessment performance grades.

The addition of direct cardiovascular reactivity measurement bypasses the participants' subjective interpretation of their physiological response and, as such, is considered an objective measure of physiological stress (McEwen, 1998; O'Connor et al., 2021). More specifically, cardiovascular data (HR, CO, TPR) were recorded continuously during a 10-minute lab session in which participants listened to a 4.5-minute guided relaxation (baseline), 2.5-minute assessment instructions (stressor), and then mentally prepared for their upcoming presentation (coping response) for an additional 2 minutes. In line with challenge/threat research, residualized change scores for CO and TPR (baseline → task) were computed, and a Challenge–Threat Index (CTI) was derived by weighting CO positively and TPR negatively.

The timings and the content of each section of the measurement and analysis were informed by previous research. For example, a baseline CVR measurement was taken over a 5-minute period; however, the last minute of baseline measurement was compared with the first minute of the mental preparation task to confirm cardiovascular reactivity to the task (Miller et al., 2021). Later, in the study analysis, residualized change scores were calculated to determine reactivity and confirm a Challenge or Threat response accordingly (Turner et al., 2024; Zumbo, 1999).

Second, initial data collection and preliminary analysis of study 1, timepoint 1 data, were used to inform changes in psychometric surveys. For example, a different measure of social support was adopted to align more closely with the second aim of this thesis. Additionally, a measure of affect was introduced in study 2, aligned with research on challenge and threat (e.g., Chadha et al., 2019; 2023). Lastly, participants' assessment grades were recorded as an objective measure of academic performance.

Methodological changes led to differences in the analysis between study 1 and study 2. Starting with the similarities, the hierarchical regressions incorporating the theoretically integrated model of resource appraisals (Step

1), social resources (Step 2), and irrational beliefs (Step 3) were utilised to predict wellbeing and performance.

Hierarchical regressions, similar to those in Study 1, examined the entire integrated biopsychosocial theoretical model. However, analysis decisions were informed by the sample size and analyses using study 1 data. These are as follows: the hierarchical regressions consisted of three, not four, models. The demographics were excluded from the model steps for two reasons. First, they failed to consistently present the model predictors as significant in study 1, and the reduction in regression models aligns better with the reduced sample size in study 2. The remaining three-model hierarchical regressions were then utilised to predict outcome variables and CVR responses to the assessment instructions.

Lastly, exploratory analyses grouped participants as “challenge” or “threat” responders, and independent-samples t-tests and z-score plots examined between-group differences in the psychosocial variables. This was a novel approach utilising available data to test for statistically significant differences between participants. Detailed results, discussion and limitations are presented in Chapter 4.

2.3.3 Study 3: Exploratory COPDMS intervention study

The third study, presented in Chapter 5, combines established research and intervention methodology in a novel approach to address the first and third aims of this thesis. Key methodological features of the study include the comparison between the intervention and control groups, the theoretical integration tested in studies 1 and 2, cardiovascular responses to COPDMS instructions, and the related impact on participants’ wellbeing and predicted academic performance.

As such, Study 3 is an exploratory social-cognitive intervention study that evaluates the impact of a coping-oriented personal disclosure mutual sharing (COPDMS) session on HE students’ biopsychosocial resources and wellbeing. The design is a 2 (group: COPDMS vs control) × 3 (time: baseline, post-session, follow-up) structure, with cardiovascular data collected for a subsample of COPDMS participants during a preparatory lab session.

The choice of intervention was driven by four indicators. Firstly, the COPDMS intervention was chosen for its theoretical alignment with challenge/threat and social identity theories. Second, PDMS benefits from a strong evidence base in motivated performance populations (e.g., Evans et al., 2018). Third, COPDMS has been applied with student populations in higher education, with qualitative indicators of the intervention impact (e.g.,

Evans et al., 2022). Finally, the COPDMS intervention offers practical benefits, including scalability and efficient delivery.

Next, in alignment with studies 1 and 2, study 3 continues to test the theoretical integration of challenge and threat appraisals and cardiovascular responses with social and cognitive phenomena. The addition of objective cardiovascular responses to COPDMS was utilised in alignment with study 2 and due to the availability of the procedure. It is a novel approach that offers insight into the psycho-physiological experience of COPDMS among participants in the intervention.

Furthermore, in alignment with study 1, study 3 aimed to utilise a three-time-point approach and observe the changes in research variables over time, pre- and post-intervention, as well as at a 4-week follow-up. Lastly, the success of the intervention was evaluated in alignment with existing research. More specifically, changes to participants' perceptions of psycho-social coping resources, wellbeing, predicted academic performance, and positively valanced social validation reports.

Ninety-five undergraduate students who completed baseline measures were included in the analyses (68 intervention, 27 control). Participants were drawn from two cohorts, each split into one intervention group (COPDMS) and one control group by existing teaching/seminar groups. Utilising existing academic groups was an effective approach to participant grouping, and avoiding cross-grouping students aligns with the natural formation of academic social groups. From a practical perspective, this method would align with future intervention, research and replication.

COPDMS participants completed: (a) baseline surveys in week 1; (b) an individual lab session in which cardiovascular responses were recorded during a relaxation plus COPDMS-instruction video and a mental preparation period; (c) a group COPDMS session in week 2 embedded within their normal seminar; and (d) a follow-up online survey 5–7 weeks later. Control participants attended an academic skills session in week 2 and completed parallel surveys at the same timepoints.

The study schedule and participant group selection decisions were based on two key considerations. First, the COPDS intervention aims to streamline the formation of social relationships and identity. It was therefore decided to engage with cohorts that have not engaged in person prior to the academic year (of the study), and that the beginning of the academic year is an appropriate time to run the intervention (in line with Evans et al., 2022). Second, practicality considerations around participant burden dictated that the beginning of the academic year would be lower and that engagement would be highest, compared to the rest of the academic year, when students are engaging with assessments.

Study 3 adopts a different analytical approach compared to studies 1 and 2 to test the study hypotheses and meet the first and third aims of this thesis. Study 3 adopts a test-of-differences approach by examining differences between the intervention and control groups and between time points. Additionally, exploratory analyses aligned with Study 2 were utilised to test for appraisal differences between challenge and threat responders, as predicted by TCTSA (Jones et al., 2009). Lastly, social-validation data from open-ended questions were analysed using inductive content analysis to capture participants' subjective experiences of COPDMS, again in alignment to previous research (Evans et al., 2022). Detailed results, discussion and limitations are presented in Chapter 5.

2.4 Cross-study methodological principles

Across Studies 1–3, a set of shared methodological principles operationalise the thesis's realist, post-positivist stance. First, constructs central to the biopsychosocial model – wellbeing, affect, resource appraisals, social identity, social support, and irrational beliefs – are assessed with established, psychometrically validated instruments. Where necessary, items are contextually adapted (e.g., from "sport" to "studies" or "assessment") while preserving their underlying structure and scoring procedures.

Second, the analytic strategy consistently uses general linear models that are well-suited to the research questions and data structure. Cross-sectional relationships are examined using hierarchical multiple regression to test incremental contributions of theoretical blocks (demographics, resources, social variables, irrational beliefs). Longitudinal and repeated-measures questions are addressed with fixed-effects regressions and repeated-measures ANOVAs/MANOVAs to separate within-person change from between-person differences. In Studies 2 and 3, cardiovascular data are modelled via residualized change scores and combined into challenge/threat indices that align with existing biopsychosocial challenge–threat frameworks.

Third, all studies were conducted in naturalistic higher-education settings (seminars and assessments), balancing experimental control with ecological validity. Wherever possible, measurements were obtained in close temporal proximity to the naturally occurring stressor (e.g., assessment) or intervention to capture acute appraisals and physiological responses without disrupting normal teaching and assessment processes.

Finally, ethical considerations were embedded throughout. Each study received institutional ethical approval (see Appendix: Ethical Approval for the three studies). Participants provided informed consent, were reminded of

their right to withdraw without penalty, and were signposted to university wellbeing services where tasks involved stress induction (e.g., assessment preparation, public speaking, personal disclosure). Data were anonymised, stored securely, and reported only in aggregate.

2.5 Summary and linkage to empirical chapters

In summary, this chapter has outlined the thesis's realist ontological stance, post-positivist epistemology, and quantitative biopsychosocial methodology. Studies 1–3 operationalise this biopsychosocial framework through longitudinal, quasi-experimental, and exploratory intervention designs that capture student wellbeing, performance, and biopsychosocial responses in naturalistic higher-education contexts. The subsequent chapters present, in turn, the introduction, detailed methods, results, and discussion for each study, thereby illustrating how the overarching framework is applied and tested across the three empirical investigations.

Chapter 3. Antecedents of challenge and threat states and their impact on wellbeing and academic performance in university students: A longitudinal study

3.1. Introduction

Chapter one outlined theory and research on how stress influences psychophysiological reactivity (challenge/ threat responses) and the resultant influence on wellbeing and performance in a motivated performance environment. The narrative also detailed the role of personal (self-efficacy, control and achievement goals) and social (support and identity) resource appraisals along with cognitive predispositions (irrational beliefs) as antecedents to challenge and threat responses. To advance and gain greater understanding of these antecedents to challenge/threat responses, the current chapter explores the impact of personal (self-efficacy, control and achievement goals) and social (social support and identity) resource appraisals, and cognitive predispositions (irrational beliefs) have on higher education (HE) students' wellbeing and performance expectations. More specifically, to address the first and second aims of this thesis, the focus of the current chapter is within the HE student context where student wellbeing is a growing concern, with many students facing mental health challenges and a decline in psychological wellbeing (Douwes et al., 2023).

3.1.1. Stress and performance in HE

Some of the key stressors faced by students in HE are linked to academic performance, retention rates, and long-term personal development (Chaudhry et al., 2024; Pekrun, 2016; Sosu & Pheunpha, 2019). More specifically the pressure to perform academically is likely to be accompanied by intense emotions and increased psychophysiological activation (Cassady

& Johnson, 2002; Malkoc et al., 2023; Pekrun, 2016) and in some cases poorer health (Kang et al., 1997). Where this activation is combined with a low tolerance for uncertainty, students become more likely to experience anxiety and underperform (Cassady et al., 2024). Importantly, how a student responds to and copes with HE stressors can vary and not always be seen as debilitating, as personal and social resources may present as stress buffer (Zimmerman et al., 2019).

Prominent in the stress and performance literature are challenge and threat models of stress. Challenge and threat states was formally conceptualised under the biopsychosocial model of performance (BPSM; Blascovich & Mendes, 2000; Blascovich & Tomaka, 1996) and was later incorporated into the theory of challenge and threat states in athletes (TCTSA/TCTSA-R; Jones et al., 2009; Meijen et al., 2020). Grounded in early stress physiology (Bernard, 1865; Cannon, 1929; Selye, 1936; 1976) and the later transactional model of stress (i.e., cognitive appraisals; Lazarus & Folkman, 1984), challenge and threat responding takes place under circumstances of high personal importance and where the individual is required to exert effort for (e.g., academic assessments). These circumstances of high personal importance are also known as a motivated performance situation. The resulting challenge or threat response encompasses a multifaceted set of elements, including cognitive appraisals of demand and resources, physiological responses (not reviewed in this chapter), emotional and behavioural aspects. The research presented in this chapter specifically focuses on personal and social appraisals and predisposing beliefs. A summary of these concepts is presented next, followed by specific details of the present study.

3.1.2. Demand and resource appraisals in HE

As detailed in chapter one, cognitive appraisals of situational demands and coping ability (Lazarus & Folkman, 1984) and the resultant challenge or threat states (Jones et al., 2009) can be used to explain individual differences in responding under similar circumstances. Goal directed behaviour (e.g., study) and subsequent motivated performance (e.g.,

academic assessments) are first evaluated through the two-stage cognitive appraisal process (Lazarus & Folkman, 1984). At the first stage, the primary appraisal, the importance and demand of the situation is evaluated as either benign or strenuous (Jones et al., 2009). For example, students are likely to appraise the demands of HE as high effort required (e.g., lecture attendance, group work, reading, writing for assessments) and thus the HE context as high demands.

At the second stage, the secondary appraisal, the psychological resources available to meet these demands are evaluated as either sufficient or insufficient. For example, their writing self-efficacy, organisational skills and ability to follow through with study tasks (control). Depending on how the demands and resources measure in comparison to each other the individual is either threatened (Threat state; where demands outweigh the resources) or challenged (Challenge state; where the resources are sufficient to meet the demands; Jones et al., 2009). Physiologically challenge and threat states are identified by an increase in neuro-endocrine and cardiovascular activity (e.g., increase in adrenalin levels and heart rate). Psychologically challenge and threat responses differ from one another in emotional valence and behavioural responses (Meijen et al., 2020).

A key contribution to challenge and threat theory by the TCTSA is the introduction of specific resource appraisals (Jones et al., 2009). Task self-efficacy (Bandura, 1997), control over actions (Skinner, 1996) and achievement goals (Elliot & McGregor, 2001) were the three universal resource appraisals suggested as key to the resultant challenge/threat response. The TCTSA suggests that the superior challenge state is the result of the individual appraising themselves as highly capable of executing the necessary behaviours to succeed (high self-efficacy), along with a clear objective focus on the controllable factors of the situation (control) and attention directed towards success (approach goals) as opposed to avoiding failure (avoidance goals). Whereas in the presence of low self-efficacy, control, approach goal and high avoidance goal appraisals are more likely to respond to the same situation with a threat response.

3.1.3. Social resource appraisals in HE

Later developments in TCTSA (TCTSA-R; Meijen et al., 2020), integrate social dispositions, more specifically, social support (Shumaker & Brownell, 1984) as a psychosocial resource, thus expanding TCTSA from a psychophysiological model of performing under pressure to a biopsychosocial one. Psychosocial factors such as, social support have been evidenced to facilitate psychophysiological arousal, appraisal and be facilitative to performance and wellbeing (DeFreese & Smith, 2014; Freeman & Rees, 2009; Tamminen et al., 2019). More specifically, evidence demonstrates the facilitative impact of weak social connectedness in eliciting the inferior, threat (as opposed to the superior, challenge), state (Slater et al., 2018).

Social support is a multidimensional concept, defined as an interaction between a provider and receiver, involving the exchange of resources to benefit the receiver (Shumaker & Brownell, 1984). Social support can include support structures (a support network), with functional (acts of support) and perceptual (availability) aspects that serve to reduce exposure to stress and enhance coping (Bianco & Eklund, 2001). More specifically, the literature differentiates between received (functional) and perceived (perceptual) social support (Cohen & Wills, 1985). Research evidence highlights perceived social support as a key indicator for wellbeing (Uchino, 2009). Hence, the way that the availability of social support is appraised (perceived) can establish it as a social coping resource. For example, emotional support, which provides a sense of safety and security in stressful situations, is likely to influence students' capacity for coping and enhance wellbeing (Green et al., 2021).

The source of social support has been identified as important in determining how support in appraised. The importance of sharing a social identity with the support provider is emphasised in the evidence base (Brown & Fletcher, 2017; Miller et al., 2021; Slater et al., 2018). For example, a shared social identity between support provider and support recipient is likely to increase the magnitude and effectiveness of the support. Research in academia found

that the absence of a shared identity within a cohort of HE students can present as a barrier to coping with academic stressors and lead to increased frequency of dropping out considerations (Scanlon et al., 2020; Pedler et al., 2021). Additionally, a sense of belonging and identification with others in the HE environment has been linked to effective academic engagement (Pedler et al., 2021; Ulmanen et al., 2016).

The social support students receive from their families, friends and academic community may influence students' response to academic stressors (Mishra, 2020). For example, family support is seen as crucial for meeting needs for acceptance, love, emotional support, encouragement and ability to cope with academic stressors (Kotyśko & Frankowiak, 2025). Where the absence of this support relates to higher risk of academic stress, depression and unhelpful stress reactivity (Kotyśko & Frankowiak, 2025; Levens et al., 2016). Separately, friends and peers have been identified as a key source for social support in academic settings, negatively predicting the development of depressive symptoms (Mishra, 2020).

As such social support can be seen as protective against poor wellbeing and facilitative of effective coping. Furthermore, in the academic context perceived availability of social support is likely to be enhanced by a shared social identity. Additional, influence on wellbeing and effective coping in performance environments such as HE, is likely to arise from predisposing beliefs, i.e. irrational performance beliefs (Meijen et al., 2020; Turner et al., 2024).

3.1.4. Irrational performance beliefs in HE

Irrational as opposed to rational beliefs are dogmatic, rigid cognitions, inconsistent with social reality and often hinder long-term goal attainment and psychological wellbeing (Wood et al., 2017). They often underpin greater negative affect in performance environments, which has been related to threat appraisals and subsequent underperformance (Chadha et al., 2019; 2023). The alignment between cognitive appraisal theory (CAT; Lazarus, 1991) and rational emotive behavioural therapy theory (REBT; Ellis, 1962) has been recognised, for the role of predisposing beliefs about the self and

the world, in responding to a situation of high personal importance (i.e., motivated performance; Turner et al., 2024). Meijen and colleagues (2020), positioned irrational beliefs as a psychological predisposing factor to challenge and threat responding in the TCTSA-R. More specifically, the four core irrational beliefs, one primary (demandingness) and three secondary (self/other/life depreciation, awfulizing and discomfort/frustration intolerance; Ellis, 1962), have been evidenced to impact performance and wellbeing (Chadha et al., 2019; 2023; Wood et al., 2017).

Researchers have uncovered a link between irrational beliefs and elevated anxiety, depression and underperformance under pressure (Mesagno et al., 2021; Visla et al., 2016). More specifically the work of Chadha and colleagues (2019; 2023) found two psychological patterns in golfers. First, irrational beliefs are often adopted in performance contexts, especially ones of high personal importance. Second, threat appraisals (based on TCTSA; Jones et al., 2009) share a positive association with irrational beliefs and a negative one with facilitative cognitive appraisals (i.e., that stress/arousal is facilitative to performance; Chadha et al., 2019; 2023). Separately, when irrational performance beliefs were studied in student-athletes, they were found to influence both athletic and academic performance (Everson & Terjesen, 2023). Finally, irrational beliefs were found to correlate positively to academic motivation (similar to the first pattern observed in golfers) and negatively to academic self-efficacy (a cognitive resource appraisal; Ozer & Akgun, 2015).

3.1.5. Literature integrating social factors and irrational beliefs

At present there are few studies that have examined the combined influence of social resources (i.e., support and identity) and cognitive predispositions (i.e., irrational beliefs) on challenge and threat responses, wellbeing or performance. One study from South Korea measured irrational beliefs, social support, and social anxiety in middle-school students and found that a combination if irrational beliefs, emotional and family support predicted social anxiety (Choi & Kim, 2008). Where social anxiety was positively correlated with irrational beliefs and negatively correlated with social support (Choi &

Kim, 2008). Separate research into sports coaches found that threat state correlated positively with irrational beliefs and a challenge state correlated positively with social support (Dixon et al., 2017). Here, coaches demonstrated a tendency to avoid social integrations within the presence of high irrational beliefs and threat appraisals. A later commentary publication by King and colleagues (2022) suggested that irrational beliefs prevalent among the support network of athletes likely play a role in athlete wellbeing and performance.

Considering the patterns of influence observed on both student wellbeing and performance from social support, social identity and irrational beliefs it would be advantageous to explore these links further. In doing so, the present chapter (and overall thesis) will enhance our understanding of students' biopsychosocial responses to HE across the academic year. The present study will test the suggested broader biopsychosocial outlook of the revised TCTSA framework (Meijen et al., 2020) via a repeated measures design and address some of the cross-sectional design limitations of previous research. Furthermore, by expanding the understanding of social and personal predispositions on challenge and threat responding, wellbeing and performance in HE students, this study explores potential pathways for positively impacting on students' academic experience.

3.1.6. The present study aims and design

The aim of the present study was to examine the influence of challenge and threat antecedents (Jones et al., 2009) social and psychological predispositions (Meijen et al., 2020) on students' self-reported wellbeing and predicted academic performance. In doing so, this study addresses the first and second aims of this thesis. Namely, to test the integration of social resources (perceived social support availability and social identity) and cognitive predispositions (irrational beliefs) into the TCTSA (a biopsychosocial approach), by testing their influence on challenge and threat resource appraisals, student wellbeing and performance over time (across one academic year). This study adopts a repeated measures research design, where the integrated biopsychosocial approach is utilised towards

predicting student self-reported wellbeing and self-predicted academic performance across the academic year.

The following hypotheses will be tested:

H1. High resource appraisals (i.e., self-efficacy, control, approach goals and avoidance goals) will be associated with greater wellbeing as well as performance expectations in motivated performance (Jones et al., 2009; Malkoc et al., 2023; Spătaru et al., 2024).

H2. High social resource appraisals (i.e., social support and social identity):

H2a) Students' multidimensional social support will be associated with greater student wellbeing (Levens et al., 2016; Shumaker & Brownell, 1984) and performance expectations (Freeman & Rees, 2010).

H2b) Students' social identification with the university will be associated with greater student wellbeing (Zwettler et al., 2018) and performance expectations (Slater et al., 2018; Wilkins et al., 2015).

H3. Irrational performance beliefs will be associated with poorer performance predictions (Chadha et al., 2019, 2023; Everson & Terjesen, 2023; Meijen et al., 2020) and wellbeing (Banks, 2011; Choi & Kim, 2008; Wong, 2008).

H4. There will be magnitude and directional changes in student wellbeing, performance expectations and resource appraisals across the academic year, which will be mapped via explorative analysis of variance. Whereas social support and irrational beliefs are expected to remain stable.

The following study analysis and results will be structured and presented based on the key outcome variables:

Wellbeing: Based on existing literature, high task-relevant resource appraisals (self-efficacy, control, approach goals and avoidance goals) are expected to contribute positively to students' wellbeing (H1; Jones et al., 2009). Additionally, perceived social support availability and a social identification with the university institution are expected to contribute positively to students' wellbeing (H2; Levens et al., 2016; Scanlon et al., 2020; Shumaker & Brownell, 1984). Finally, high prevalence of irrational performance beliefs is expected to contribute negatively to students' wellbeing (H3; Choi & Kim, 2008; Turner et al., 2024; Wong, 2008).

Predicted performance: Based on existing literature, high task-relevant resource appraisals are expected to contribute positively to students' performance (H1; Jones et al., 2009; Malkoc et al., 2023). Additionally, perceived social support availability and a social identity with the university institution are expected to contribute positively to students' performance (H2; Freeman & Rees, 2010; Mishra, 2020; Slater et al., 2018). Finally, high prevalence of irrational performance beliefs is expected to contribute negatively to students' performance (H3; Chadha et al., 2019, 2023; Everson & Terjesen, 2023; Meijen et al., 2020; Turner et al., 2024).

Temporal changes (H4): with time spent in the academic environment increasing from the start of the study to the end of the study, and the state level of measurement, we expect that students' task-relevant resource appraisals and their university social identity, will change as an effect of time passing. Separately, students social support and irrational beliefs are expected to remain stable across the academic year, due to the inherent stability of these social and psychological predispositions and the level of measurement (trait scales). Temporal changes will be explored via an additional exploratory analysis to test magnitude and directionality of changes. These are tentatively hypothesised due to missing evidence base.

3.2. Methodology

3.2.1. Study design

The study utilised a repeated measures within-subjects design, where all participants were asked to complete the same psychometric measures three times during the 2021/2022 academic year, more specifically at the start (weeks 1 to 4; October 2021), middle (weeks 12 to 16; January 2022) and end weeks (weeks 22 to 26; May 2022).

3.2.2. Participants

The sample size estimation was calculated using G*Power (Faul et al., 2007), indicating that for a medium effect size (f2= 0.15, $p < 0.05$) with a power of 0.80 (Chadha et al., 2019), a sample size of 85 participants was required. The study recruited a total of 650 participants from a higher education institution in England, with complete responses recorded from 566 (*M*age = 24.96, SD = 8.41; youngest 18, oldest 61 on the 1st of September 2021) university students. Of these, 511 participants responded on the first timepoint of the study, 261 in the second timepoint of the study, 158 in the third timepoint of the study. Due to different individuals completing the study at each timepoint, only A total of 73 participants completed all three timepoints of the study, a total dropout rate of 577. **The study recruited fewer than the 85 participants across all three timepoints.** Participants disclosed their gender identity (Table 1), nationality (470 British/English, 95 international), disability status (461 no disability, 86 living with disability and 17 undisclosed), and family education status (295 were the first in their families to attend university, 237 were not, 31 undisclosed). All participants were offered an entry into a £50 Amazon voucher prize draw for their participation.

Table 3.1: Participant demographics.

		N	%
Biological sex	Female	316	48.6%
	Male	240	36.9%
	Specify self	2	0.3%
	Decline to answer	8	1.2%
Gender identity	Woman	307	47.2%
	Man	231	35.5%
	Specify self	20	3.1%
	Decline to answer	8	1.2%
Total reported		566	87.1%
Missing data		84	12.9%

3.2.3. Measures

Participants completed psychometric measures via online survey on the Qualtrics software. All psychometric measures had been validated and used in research previously. The following surveys were completed by all participants at the three timepoints of the study.

The Warwick–Edinburgh Mental Well-being Scale (WEMWBS; Tennant, et al., 2007) - WEMWBS is a 14 item Likert scale ranging from “none of the time” (1), to “all of the time” (5). Higher scores indicate better wellbeing over the last two weeks (e.g., “I’ve been feeling good about myself”). Cronbach’s alpha = 0.91 of the unidimensional factor structure (Tennant, et al., 2007).

Self-predicted performance – Measured via a single item asking participants “Based on your best personal prediction, what will be your grade on this assessment?”. Participants responded on a 5-point scale: 1: 39% or below (fail); 2: 40-49%; 3: 50-59%; 4: 60-69%; 5: 70%+.

The Multidimensional Scale of Perceived Social Support - MSPSS (Zimet et al., 1988) – The MSPSS is a 12 item Likert measure, scored form 1 (Very Strongly Disagree) to 7 (Very Strongly Agree). Measures three subscales, each addressing a different source of support (Cronbach’s alpha in university students): (a) Family (0.85 to 0.87), (b) Friends (0.75 to 0.85), and (c) Significant Other (0.72 to 0.91). The reliability of the full scale – 0.85 to 0.88 making it a reliable measure to use in this study. The data from each participant is calculated into three mean scores one for family, friends, and significant other.

The irrational Performance Beliefs Inventory 2 - iPBi -2 (Turner & Allen, 2018) – a 20 item Likert scale (shortened from the original 28item iPBi; (Turner M. J., et al., 2016) rated from 1 (Strongly Disagree) to 5 (Strongly Agree) with Alphas ranging for 0.76 to 0.84. The shorter scale was chosen based on it having similar strength of validity as the original (Turner et al., 2018), in addition to the fewer items, posing less participation burden. The data from each participant is calculated into one mean global rating of irrational performance beliefs.

The Four Item Social Identity measure - FISI - Originally proposed by (Doosje et al., 1995) and adjusted by (Postmes et al., 2013) the Four Item Social Identity (FISI) measure is a four-item measure of Social Identification, measured from 1 (Strongly Disagree) to 7 (Strongly Agree). Cronbach's alpha = 0.77. The data from each participant is calculated into one mean score of Social Identity.

Challenge and Threat resources, previously validated and extensively used, with recent Cronbach alpha's of ≥ 0.81 (Slater et al., 2018; Miller et al., 2020; 2021)

- **Task importance** – A single item "How important is it for you to perform well in your studies?" measure, rated from 1 (not at all) to 5 (very much so). This perceived importance is a common measure of challenge and threat responses (Blascovich et al., 2004; Jones et al., 2009). Utilised to confirm participant's motivation to perform as a prerequisite for challenge and threat responses to being observed.
- **Self-efficacy** - Two items "To what extent do you feel confident that you can perform well within your studies?" and "To what extent do you feel confident that you can fulfil your potential?", measuring how confident participants feel about performing well in their studies. Rated on a Likert scale from 1 (not at all), to 5 (very much so). Used extensively in challenge and threat research (Miller et al., 2020), these items were adopted from earlier work on perceptions of confidence over academic achievements (Perry et al., 2001). Participants' confidence is scored by adding up the responses to the two items and then dividing them by two (the number of items).

- **Control** – A single item “The more effort I put into my studies, the better I will do.”, measure of participants perceived Control over their academic achievements, rated on a on a Likert scale from 1 (not at all), to 5 (very much so). Used extensively in challenge and threat research (Miller et al., 2020), these items were adopted from earlier work on perceptions of control over academic achievements (Perry et al., 2001).
- **Achievement goals**- The shortened Achievement Goal Questionnaire (AGQ; Conroy et al., 2003) was used to identify participants’ motivational disposition towards their studies. The AGQ assesses mastery approach goals (Map; “It is important to me to perform as well as I possibly can”), mastery avoidance goals (Mav; “I worry that I may not perform as well as I possibly can”), performance approach goals (Pap; “It is important to me to do well compared to others”), and performance avoidance goals (PAv; “I just want to avoid performing worse than others”), via 4 items rated from 1 (strongly disagree) to 7 (strongly agree). Each participant receives a score for Approach (MAp and PAp) and Avoidance (MAv and PAv), each calculated by adding up the two items and dividing by two (the number of items).

3.2.4. Procedure

Participants were approached by the lead researcher at three timepoints during their lectures of the year, at student events, via their department administrators, lecturers and via email. They completed the same battery of surveys via an online survey software (Qualtrics) at all three timepoints. The battery of surveys took around 15 minutes to complete each time. Participants were offered entry into a prize draw for their participation at teach timepoint of the study. The survey order prioritised psychometrics data collection over demographics data collection. For example, all participants were presented with the WEMWES survey first, followed by the remaining psychometrics, and finally participant demographics.

3.2.5. Analytic strategy

The data were examined for normality and influential outliers on variables of interest. Two participants were identified as extreme outliers (z = - 5.15) and their responses were omitted from further analysis. One participant's data was omitted due to missing over 95% of their response data. The remaining data from 648 participants were analysed. Data on variables related to task relevance, and perceived control over actions were skewed, Skewness was -1.412 and -2.066 respectively, and Kurtosis was 1.562 and 4.059 respectively. Based on the population tested and the context, skewness in these variables is expected.

Hypotheses one, two and three were tested through eight repeated four-step regression analyses where either wellbeing or predicted performance is positioned as the dependent variable. Model/step 1s isolated the explained variance owed to participant demographics (age and biological sex). Model/step 2s tested H1, the explained variance owed to the four resource appraisals (task self-efficacy, task control, task approach goals and task avoidance goals; Jones et al., 2009). Model/step 3s tested H2, the explained variance owed to social resources (multidimensional social support and university identity; Meijen et al., 2020). Model/step 4s tested H3, the explained variance owed to irrational performance beliefs (Banks, 2011; Chadha et al., 2019; David & Cramer, 2009; Wood et al., 2017).

Analyses were completed in 4 phases to test H1, H2, H3 and H4. First, Pearson correlations were carried out to examine the relationship between the main dependent variables (wellbeing and predicted performance), and how these relate to resource appraisals (task self-efficacy, task control, task approach goals and task avoidance goals; where the task is academic performance), social resources (multidimensional social support and university identity) and irrational performance beliefs. The correlations were used to confirm internal correlation for each of the variables across the three timepoints, correlation between the dependent and independent variables withing each of the timepoints, and correlation between the dependent and independent variables across the timepoints.

At the second phase of the analysis, six four-step hierarchical regression analyses were conducted to test the explained variability in wellbeing and predicted performance at each time-point of the study (start, middle, end of the academic year). Age and biological sex were entered at step one for each of the six regressions, in order to control for the influence of demographics in later models. The four resource appraisals (task self-efficacy, task control, task approach goals and task avoidance goals) from the corresponding timepoint were entered at step two to test H1 at each of the timepoints. The two social resources (multidimensional social support and university identity) were entered at step three, to test H2 at each of the timepoints. Finally, irrational performance beliefs were entered at step four, to test H3 at each of the timepoints. Note, that separating the variables into each step and observing the changes in ß – ta values allow us to observe how independent variables interact with one another to explain variability in the dependent variables. Additionally, the order of the steps has been informed by theory, e.g., irrational beliefs are predicted to have both a direct and an indirect influence (via personal/social resource appraisals) on the dependent variable.

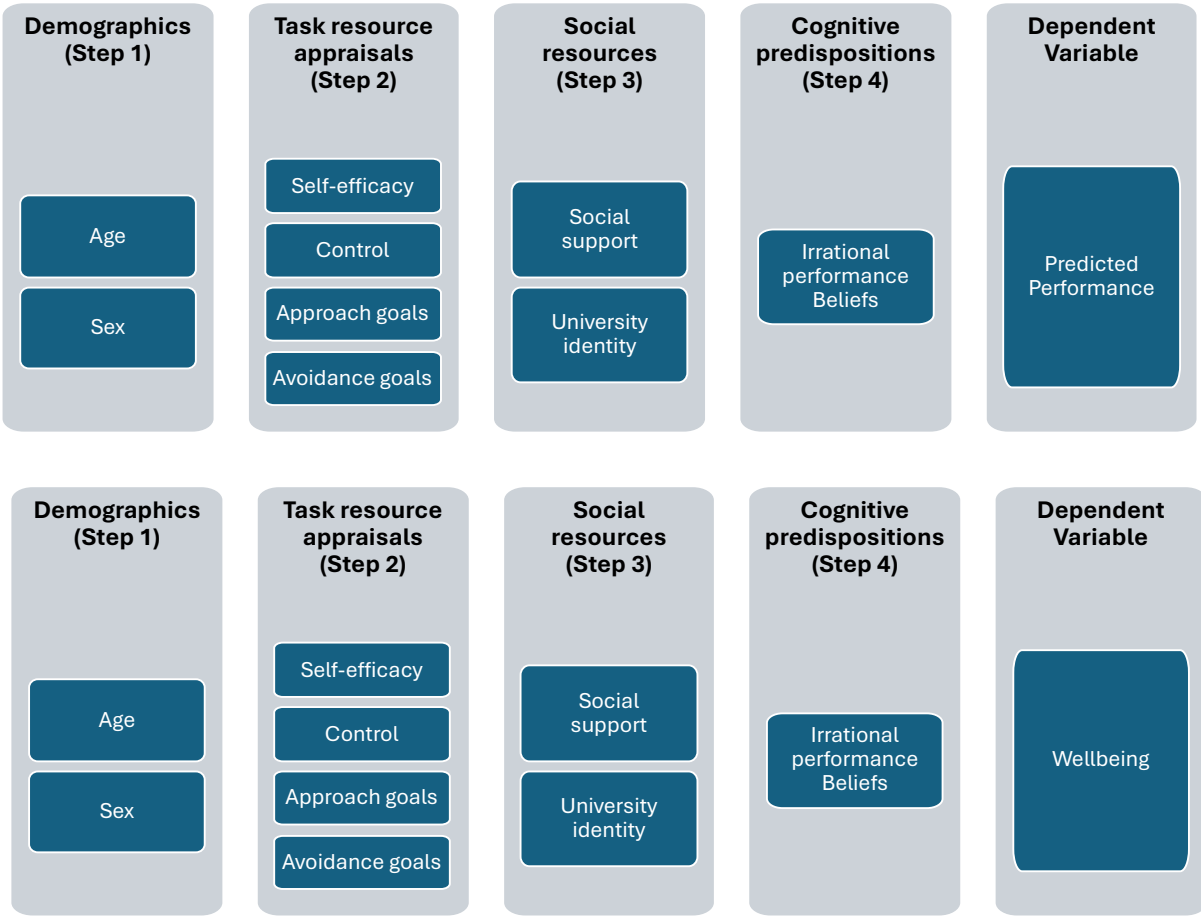


Figure 3.3:Variables included at each step of the six a-temporal four-step regressions.

At the third phase, two four-step hierarchical regression analyses, i.e. a fixed effects repeated measures regression analysis predicting wellbeing and predicted performance with the same four steps as the phase two regressions, while controlling for variability in each of the variables across time. Here dummy variables were used to control for the effects of previous timepoints (step 1). The demographics data was excluded from the models and replaced by the dummy variables. This is done for two reasons. First, fixed effect methods cannot estimate coefficients for variables that have no within-subject variability (e.g. sex). Second, the dummy variable coding reduces bias from un-measured or un-represented variables and accounts for between person/case variability (Allison, 2005; McNeish & Kelley, 2019). Hence, stable factors such as demographics are excluded from the analysis due to their potential for collinearity with the dummy variables. Resource appraisals were added at step 2, to test H1 across the three timepoints.

Social resources were added at step 3, to test H2 across the three timepoints. Irrational performance beliefs were added at step 4 to test H3 across the three time points.

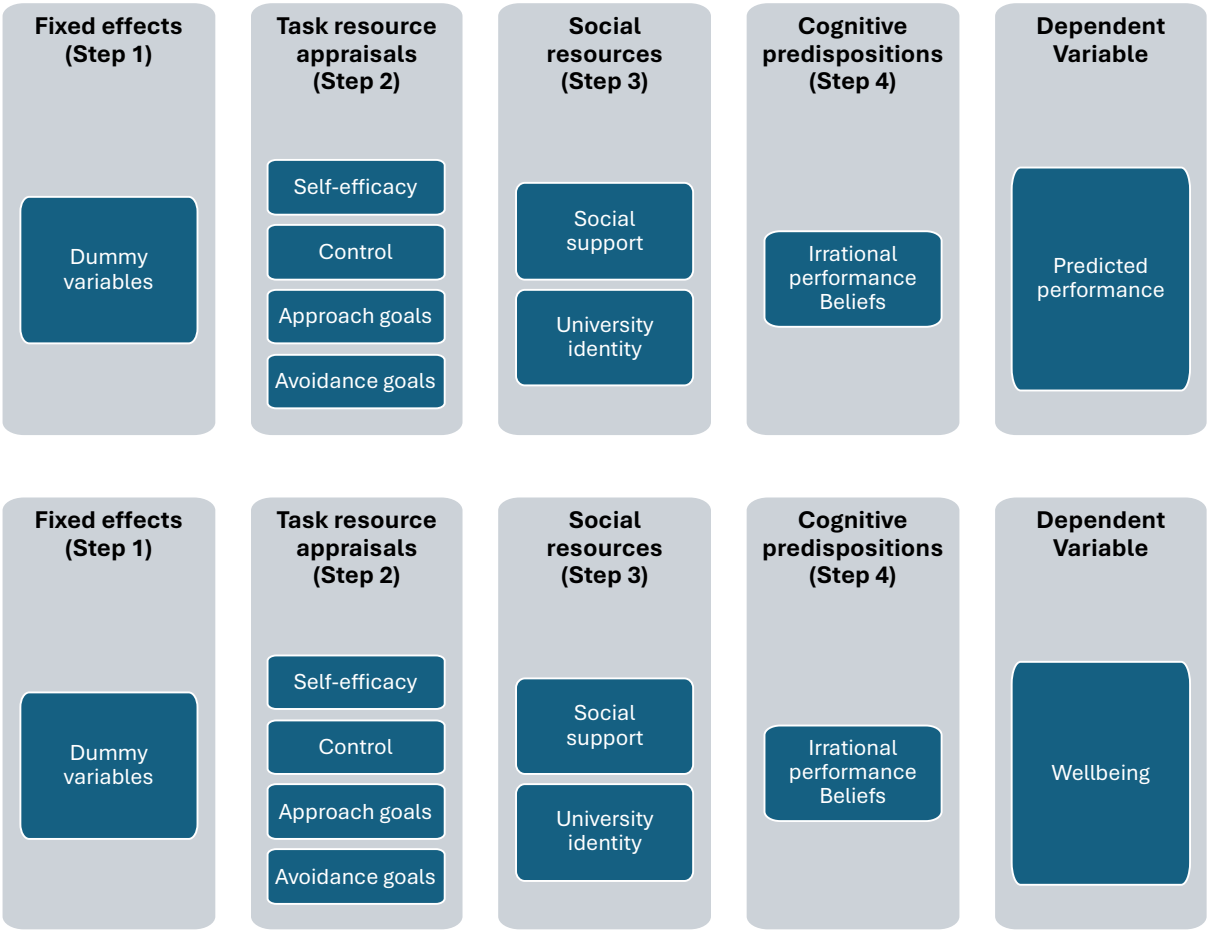


Figure 3.4: Variables included at each step of the two fixed effects four-step regressions.

At the fourth phase, separate exploratory repeated measure analyses of variance (ANOVAs) were conducted to visualise the change in wellbeing and predicted performance across the three timepoints of the study (start, middle, and end of the academic year; H4). An exploratory repeated measure multivariate analysis of variance (MANOVA) was conducted to visualise the change in the four resource appraisals (task self-efficacy, task control, task approach goals and task avoidance goals; Jones et al., 2009) across the three timepoints of the study (start, middle, and end of the academic year). Next, an exploratory repeated measure analysis of variance (ANOVA) was conducted to visualise the change in participants university identity across

the three timepoints. Finally, repeated measure analyses of variance (ANOVAs) were conducted with the social support and irrational belief variables to confirm no change in participants social support and irrational beliefs across the three timepoints, as these trait variables are expected to be stable across the timeline of the study.

3.3. Results

3.3.1. Phase 1: Pearson correlations and test of engagement

Means, standard deviations, number of responses and normality and correlations are presented in Table 3.2. A visual inspection of boxplots and histograms revealed skewness in some reported appraisals (identity, task relevance and control) which is to be expected within the population tested. All measures correlate with themselves across all 3 time points of data collection (a prerequisite for repeated measures analysis).

Test of engagement: A one sample t-test was used to confirm task (academic performance) relevance. The data was skewed in favour of high importance. The means at each timepoint were 4.61 (SD=0.59) at time-point 1, 4.55 (SD=0.63) at time-point 2, and 4.55 (SD=0.65) at time-point 3, were significantly different to the test value of 1 (not important at all) by 3.62, 3.55 and 3.55 respectively, $t(468) = 131.926$, $p < .001$, 95% CI [3.56, .3.67]; $t(247) = 88.223$, $p < .001$, 95% CI [3.47, .3.63]; and $t(154) = 68.322$, $p < .001$, 95% CI [3.45, .3.65] respectively. Participants rated performing in their studies as highly important.

3.3.2. Phase 2: A-temporal hierarchical multiple regressions predicting wellbeing and predicted performance at the three timepoints (cross-sectional H1, H2, and H3).

Six hierarchical multiple regressions were run to determine if the addition of resource appraisals (Model 2: self-efficacy, control, approach and avoidance goals), then social resources (Model 3: social support and social identity), followed by irrational performance beliefs (Model 4), improved the explained variance of student wellbeing and predicted performance at each timepoint in the study, above and beyond participant demographics (age and biological sex). The data met assumptions for parametric testing, with no multicollinearity or leverage values greater than 0.2 present.

Explained variance in student wellbeing at the beginning, middle and end of the academic year

All models of demographics (step 1), resource appraisals (step 2), social resources (step 3) and irrational beliefs (step 4) to explain variance in

student wellbeing at the start, middle and end of the academic year were statistically significant (*see* Table 3.3). The addition of resource appraisals to explained variance in wellbeing (Model 2s) led to significant increases, explaining between 30-38.9% of variance at the three time-points in the academic year, Δ R^2 =.311, p <.001 at the start, Δ R^2 =.300, p <.001 at the middle, and Δ R^2 =.389, p <.001, at the end. The addition of social resources (Model 3s), more specifically the availability of multidimensional social support for each time-point analysis start (ß = .268, p <.001), middle (ß =.224, p <.001), and end (ß =.397, p <.001) added significantly to the explained variability in wellbeing. Finally, the addition of irrational performance beliefs (Model 4s) were significant predictors of wellbeing at each of the time-points: start (ß = -.223, p <.001), middle (ß = -.139, p <.05), and end (ß = -.209, p <.05).

Notably, the addition of resource appraisals, social appraisals and irrational beliefs (Model 2, Model 3 and Model 4 at the start of the academic year) reduced the explained variability in wellbeing owed to participant demographics, reducing the importance of age from ß = .121, p <.05 to ß = .037, p >.05, and sex from ß = .098, p <.05 to ß = .070, p <.05, and making these predictors no longer statistically significant and suggesting shared explained variability in wellbeing, between demographics and the study variables. Similar reductions in explained variance in wellbeing by demographics was observed in time-points two and three, however demographics remained statistically significant predictors of wellbeing.

Overall, all three regressions at all 4 steps demonstrated similar patterns of explained variability in student wellbeing. More specifically students' who have high task self-efficacy (support for one out of four theoretically linked resources; H1), high multidimensional social support availability (partial support for one out of two theoretically linked social resources; H2) and were low in irrational performance beliefs (H3 supported) were more likely to report better wellbeing.

Explained variance in predicted performance at the beginning, middle and end of the academic year

All models of demographics (step 1), social resources (step 3) and irrational beliefs (step 4) to explain variance in predicted performance at the start,

middle and end of the academic year failed to reach statistical significance (*see Table 3.3*). The addition of resource appraisals to explained variance in predicted performance (Step 2, Model 2s) led to significant increases, explaining between 14.5-23.2% of variance at the three time-points in the academic year, Δ R^2 =.147, p <.001 at the start, Δ R^2 =.243, p <.001 at the middle, and Δ R^2 =.245, p <.001, at the end. The addition of social resources at step 3 in at the Middle of the year only (Model 3 Performance Prediction: Middle of academic year), more specifically the university identity reached statistical significance, ß = -.143, p <.05, however the increase in overall explained variance in predicted performance failed to reach statistical significance (Δ R^2 =.019, p >.05, F (8,212) = 9.89, p <.001). The negative ß statistic suggests that the higher student's university identity the lower the predicted performance, this is in opposition to hypothesis H2b.

Overall, the addition of the psychological resource - task self-efficacy (Model 2s) at each time point was a statistically significant predictor of predicted performance, ß = .276, p <.001 (start), ß = .383, p <.001(middle), and ß = .451, p <.001 (end). The addition of the psychological resource – approach goals (Model 2s) at the first two time point was also a statistically significant predictor of predicted performance, ß = .179, p <.001 (start), and ß = .224, p <.001(middle).

Overall, all 3 regressions at all 4 steps demonstrated similar patterns of explained variability in predicted performance. More specifically students' who have high task self-efficacy, and high approach goals (partial support for two out of four resource appraisals; H1) were more likely to report higher predicted performance at the start and middle of the academic year. Finally at the end of the academic year predicted performance was only explained by task self-efficacy (partial support for one out of four resource appraisals; H1).

3.3.3. Phase 3: Temporal analysis, fixed effects repeated measures hierarchical regressions predicting wellbeing and predicted performance (H1, H2, and H3 across time).

All models of dummy variables (step 1), resource appraisals (step 2), social resources (step 3) and irrational beliefs (step 4) to explain variance in student wellbeing across the academic year were statistically significant (*see* *Table 3.4*). The addition of resource appraisals to explained variance in wellbeing (Model 2), more specifically task self-efficacy (ß = .202, p <.001) led to significant increase, explaining an additional 2% of variance at Δ R^2 =.008, p <.001. The addition of social resources (Model 3), more specifically the availability of multidimensional social support (ß = .283, p <.001) led to significant increase, explaining an additional 2.5% of variance at Δ R^2 =.008, p <.001. Notably, the addition of step 3, reduced the explained variance owed to task self-efficacy (to ß = .184, p <.05). Finally, the addition of irrational performance beliefs (Model 4; ß = -.170, p <.001) resulted in a significant model adding 0.7% to the explained variance in wellbeing, Δ R^2 =.002, p <.001.

The first two models, dummy variables (step 1), and resource appraisals (step 2) led to statistically significant explained variance in predicted performance across the academic year were statistically significant (*see* *Table 3.4*). The addition of resource appraisals to explained variance in predicted performance (Model 2), more specifically task self-efficacy (ß = .218, p <.05) and task approach goals (ß = .174, p <.001) led to significant increase, explaining an additional 3.2% of variance at Δ R^2 =.012, p <.001. The addition of social resources (Model 3), and irrational performance beliefs (Model 4) did not result in a significant model.

*Table 3.2: Means, standard deviations (SD), skewness, kurtosis, number of responses and Bivariate correlations. Note: *p < .05, **p < .001*

Variable	1. Self-efficacy Start	2. Self-efficacy Middle	3. Self-efficacy End	4. Control Start	5. Control Middle	6. Control End	7. Approach Goals Start	8. Approach Goals Middle	9. Approach Goals End	10. Avoidance Goals Start	11. Avoidance Goals Middle	12. Avoidance Goals End	13. Irrational Beliefs Start	14. Irrational Beliefs Middle	15. Irrational Beliefs End	16. University Identity Start	17. University Identity Middle	18. University Identity End	19. Social Support Start	20. Social Support Middle	21. Social Support End	22. Wellbeing Start	23. Wellbeing Middle	24. Wellbeing End	25. Predicted Performance Start	26. Predicted Performance Middle	27. Predicted Performance End
Mean	3.484	3.480	3.374	4.450	4.390	4.390	5.179	5.161	5.052	4.468	4.349	4.642	3.227	3.263	3.307	5.548	5.312	5.080	4.942	5.147	4.972	46.523	45.548	44.612	4.074	4.004	3.944
SD	0.854	0.828	0.862	0.947	0.898	0.864	1.122	1.102	1.126	1.502	1.408	1.323	0.690	0.657	0.710	1.336	1.394	1.590	1.391	1.318	1.413	10.104	10.706	11.696	0.838	0.854	0.867
Skewness	-0.236	-0.501	-0.398	-2.066	-2.073	-2.021	-0.026	-0.187	-0.120	-0.110	-0.280	-0.261	-0.150	0.020	-0.217	-0.837	-0.739	-0.718	-0.462	-0.574	-0.523	-0.381	-0.167	-0.189	-0.546	-0.645	-0.805
Kurtosis	-0.130	0.161	0.043	4.059	4.929	4.986	-0.776	-0.473	-0.506	-0.707	-0.431	-0.225	0.047	-0.101	0.021	0.119	-0.043	-0.291	-0.436	-0.275	-0.246	0.008	-0.326	-0.412	-0.439	0.101	0.566
N	469	248	155	469	248	155	469	248	155	469	248	155	446	244	150	441	242	150	436	242	150	509	250	157	431	230	144
1.	--																										
2.	.555**	--																									
3.	.597**	.689**	--																								
4.	.225**	-.006	.048	--																							
5.	.191*	.139*	.007	.199*	--																						
6.	.185	.082	.145	.322**	.286**	--																					
7.	.041	-.037	-.036	.164**	.101	.14	--																				
8.	.132	.091	-.017	.086	.149*	.154	.577**	--																			
9.	.105	-.123	.114	.077	.043	.029	.426**	.568**	--																		
10.	-.366**	-.388**	-.280**	-.002	-.009	.062	.471**	.344**	.282**	--																	
11.	-.094	-.267**	-.133	-.017	-.027	-.09	.299**	.485**	.379**	.481**	--																
12.	-.142	-.327**	-.275**	-.133	.067	-.103	.283**	.285**	.515**	.496**	.490**	--															
13.	-.190**	-.206*	-.295**	-.023	.017	-.04	.394**	.293**	.318**	.522**	.238**	.388**	--														
14.	-.088	-.227**	-.208	.027	-.004	-.051	.464**	.444**	.499**	.480**	.375**	.434**	.675**	--													
15.	-.077	-.293**	-.154	.015	.053	-.094	.245*	.380**	.533**	.417**	.433**	.574**	.692**	.754**	--												
16.	.254**	.201*	.093	.237**	.113	.109	.128**	.11	.121	.031	-.042	.038	.148**	.05	.197	--											
17.	.156	.121	.221*	.1	.129*	.107	.15	.130*	.069	.098	.082	-.048	.205*	.135*	.089	.716**	--										
18.	.221*	.18	.371**	.075	.059	.04	.035	-.147	.039	-.057	-.220*	-.05	.142	-.038	.071	.590**	.722**	--									
19.	.321**	.210*	.362**	.208**	.07	.124	.072	.09	.109	-.144**	.111	-.156	-.036	.053	-.04	.298**	.129	.193	--								
20.	.268**	.228**	.335**	.165	.108	-.124	.153	-.004	.178	-.005	-.014	-.055	.065	.04	-.047	.063	.214**	.072	.715**	--							
21.	.297**	.177	.362**	.132	.027	-.001	-.027	-.113	.178*	-.128	.117	-.07	-.144	-.084	.012	-.097	.131	.16	.724**	.819**	--						
22.	.532**	.368**	.567**	.198**	.118	.125	-.052	-.032	-.032	-.346**	-.104	-.257**	-.332**	-.172*	-.201*	.230**	.156	.262**	.419**	.371**	.433**	--					
23.	.468**	.501**	.537**	.06	.200**	-.029	-.180*	-.144*	-.16	-.426**	-.260**	-.234*	-.335**	-.301**	-.267*	.033	.161*	.264*	.224**	.362**	.495**	.657**	--				
24.	.476**	.462**	.628**	.14	-.022	.211**	-.153	-.321**	-.082	-.332**	-.234*	-.378**	-.417**	-.391**	-.373**	-.073	.203	.206*	.387**	.560**	.502**	.635**	.755**	--			
25.	.350**	.235**	.256**	.150**	.091	0.097	.116*	.155	-.104	-.165**	-.072	-.132	-.092	.068	-.14	.092	-.023	.058	.162**	.096	-.057	.212**	.066	.127	--		
26.	.296**	.452**	.548**	.063	.121	0.129	.037	.182**	-.153	-.209*	-.152*	-.157	-.206*	-.145*	-.237*	-.022	-.07	.018	.172*	.086	.03	.256**	.269**	.269*	.397**	--	
27.	.311**	.639**	.493**	.111	-.013	0.156	.018	.235*	.108	-.12	.036	-.14	-.127	-.159	-.039	-.008	-.002	.089	.210*	.184	.119	.259*	.332**	.228**	.372**	.742**	--
	1. Self-efficacy Start	2. Self-efficacy Middle	3. Self-efficacy End	4. Control Start	5. Control Middle	6. Control End	7. Approach Goals Start	8. Approach Goals Middle	9. Approach Goals End	10. Avoidance Goals Start	11. Avoidance Goals Middle	12. Avoidance Goals End	13. Irrational Beliefs Start	14. Irrational Beliefs Middle	15. Irrational Beliefs End	16. University Identity Start	17. University Identity Middle	18. University Identity End	19. Social Support Start	20. Social Support Middle	21. Social Support End	22. Wellbeing Start	23. Wellbeing Middle	24. Wellbeing End	25. Predicted Performance Start	26. Predicted Performance Middle	27. Predicted Performance End

Table 3.3: Hierarchical regression analyses predicting wellbeing and predicted performance at the start, middle, and end of the academic year.

	Model 1					Model 2					Model 3					Model 4				
Wellbeing Start (N = 423)																				
	B	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**	
Age	**.145***	**.058**	**.121**	**.030**	**.260**	.069	.049	.058	-.028	.166	.056	.047	.047	-.036	.149	.045	.046	.037	-.045	.134
Biological sex	**1.990***	**.987**	**.098**	**.050**	**3.931**	.453	.836	.022	-1.191	2.097	1.540	.820	.076	-.072	3.152	1.417	.796	.070	-.147	2.980
Self-efficacy						**5.538****	**.558**	**.462**	**4.442**	**6.634**	**4.511****	**.555**	**.377**	**3.420**	**5.602**	**4.358****	**.539**	**.364**	**3.299**	**5.418**
Control						**.934***	**.469**	**.085**	**.011**	**1.857**	.480	.452	.043	-.409	1.368	.305	.440	.028	-.559	1.169
Approach Goals						-.203	.435	-.022	-1.059	.653	-.434	.415	-.048	-1.249	.381	.009	.411	.001	-.799	.817
Avoidance Goals						**-1.043***	**.348**	**-.155**	**-1.727**	**-.360**	**-.888***	**.333**	**-.132**	**-1.542**	**-.234**	-.290	.343	-.043	-.963	.383
Social Support											**1.945****	**.307**	**.268**	**1.342**	**2.548**	**1.938****	**.298**	**.267**	**1.353**	**2.523**
University Identity											.446	.319	.059	-.181	1.074	.698	.313	.092	.082	1.313
Irrational Beliefs																**-3.451****	**.662**	**-.233**	**-4.752**	**-2.150**
Adjusted R^2 (R^2 change)	.017* (Δ R^2 =.022*)					.324** (Δ R^2 =.311**)					.390** (Δ R^2 =.069**)					.427** (Δ R^2 =.037**)				
ANOVA	*F* (2,420) = 4.70*					*F* (6,416) = 34.67**					*F* (8,414) = 34.79**					*F* (9,413) = 35.91**				
Wellbeing Middle (N = 233)																				
	B	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**	
Age	**.209***	**.071**	**.189**	**.068**	**.350**	**.149***	**.061**	**.134**	**.029**	**.268**	**.130***	**.058**	**.118**	**.015**	**.245**	**.119***	**.058**	**.107**	**.004**	**.233**
Biological sex	2.647	1.412	.121	-.135	5.428	1.469	1.197	.067	-.890	3.828	1.782	1.150	.082	-.483	4.047	1.561	1.143	.071	-.692	3.814
Self-efficacy						**6.423****	**.759**	**.491**	**4.928**	**7.918**	**5.619****	**.747**	**.430**	**4.147**	**7.091**	**5.157****	**.768**	**.394**	**3.644**	**6.670**
Control						**1.720***	**.651**	**.147**	**.438**	**3.003**	**1.438***	**.627**	**.122**	**.202**	**2.675**	**1.354***	**.623**	**.115**	**.127**	**2.582**
Approach Goals						**-1.806***	**.627**	**-.188**	**-3.042**	**-.570**	**-1.671***	**.604**	**-.174**	**-2.861**	**-.481**	-1.111	.648	-.115	-2.388	.165
Avoidance Goals						-.217	.507	-.028	-1.216	.782	-.422	.488	-.055	-1.384	.539	-.350	.485	-.046	-1.305	.605
Social Support											**1.823****	**.438**	**.224**	**.959**	**2.687**	**1.925****	**.437**	**.237**	**1.065**	**2.786**
University Identity											.588	.412	.077	-.224	1.399	.689	.411	.090	-.120	1.498
Irrational Beliefs																**-2.282***	**1.008**	**-.139**	**-4.269**	**-.295**
Adjusted R^2 (R^2 change)	.038* (Δ R^2 =.047*					.329** (Δ R^2 =.300**)					.384** (Δ R^2 =.059**)					.395** (Δ R^2 =.013*)				
ANOVA	*F* (2,230) = 5.63*					*F* (6,226) = 19.97**					*F* (8,224) = 19.08**					*F* (9,223) = 17.84**				

	Model 1					Model 2					Model 3					Model 4				
Wellbeing: End of academic year (N = 147)																				
	B	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**	
Age	**.269***	**.093**	**.230**	**.085**	**.453**	**.180***	**.074**	**.154**	**.033**	**.327**	**.154***	**.065**	**.131**	**.025**	**.283**	.125	.064	.107	-.002	.251
Biological sex	**4.527***	**2.009**	**.179**	**.557**	**8.497**	**3.494***	**1.573**	**.139**	**.385**	**6.604**	**4.040***	**1.391**	**.160**	**1.290**	**6.791**	**3.610***	**1.359**	**.143**	**.922**	**6.299**
Self-efficacy						**7.437****	**.913**	**.547**	**5.633**	**9.242**	**5.657****	**.900**	**.416**	**3.878**	**7.436**	**5.225****	**.886**	**.384**	**3.473**	**6.977**
Control						1.395	.829	.105	-.244	3.033	**1.669***	**.725**	**.126**	**.236**	**3.103**	**1.532***	**.706**	**.115**	**.136**	**2.928**
Approach Goals						-.394	.814	-.038	-2.003	1.214	-1.136	.719	-.109	-2.558	.286	-.417	.739	-.040	-1.877	1.044
Avoidance Goals						-1.310	.731	-.146	-2.755	.135	-1.107	.640	-.124	-2.372	.158	-.501	.653	-.056	-1.793	.791
Social Support											**3.343****	**.494**	**.397**	**2.365**	**4.321**	**3.378****	**.481**	**.401**	**2.427**	**4.328**
University Identity											-.165	.426	-.023	-1.007	.676	.039	.419	.005	-.790	.868
Irrational Beliefs																**-3.466***	**1.149**	**-.209**	**-5.739**	**-1.194**
Adjusted R^2 (R^2 change)	.077** (Δ R^2 =.089**)					.456** (Δ R^2 =.389**)					.585** (Δ R^2 =.130**)					.608** (Δ R^2 =.024**)				
ANOVA	*F* (2,144) = 7.06**					*F* (6,140) = 21.39**					*F* (8,138) = 26.77**					*F* (9,139) = 26.23**				
Performance Prediction: Start of academic year (N = 419)																				
	B	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**	
Age	.010	.005	.095	.000	.019	.006	.005	.062	-.003	.015	.006	.005	.061	-.003	.015	.006	.005	.060	-.003	.015
Biological sex	.087	.083	.051	-.076	.250	.044	.079	.026	-.111	.198	.050	.081	.029	-.110	.210	.048	.081	.029	-.112	.208
Self-efficacy						**.276****	**.053**	**.276**	**.173**	**.380**	**.269****	**.055**	**.269**	**.161**	**.378**	**.267****	**.055**	**.267**	**.159**	**.376**
Control						.052	.044	.056	-.035	.138	.049	.045	.053	-.039	.137	.046	.045	.050	-.042	.134
Approach Goals						**.136****	**.041**	**.179**	**.055**	**.216**	**.134****	**.041**	**.177**	**.053**	**.215**	**.141****	**.042**	**.186**	**.058**	**.223**
Avoidance Goals						**-.075***	**.033**	**-.135**	**-.139**	**-.011**	**-.074***	**.033**	**-.132**	**-.138**	**-.009**	-.064	.035	-.115	-.133	.005
Social Support											.017	.030	.028	-.043	.077	.016	.030	.027	-.043	.076
University Identity											-.001	.032	-.002	-.064	.061	.003	.032	.004	-.060	.066
Irrational Beliefs																-.052	.068	-.042	-.186	.082
Adjusted R^2 (R^2 change)	.006 (Δ R^2 =.011)					.145** (Δ R^2 =.147**)					.142 (Δ R^2 =.001)					.141 (Δ R^2 =.001)				
ANOVA	*F* (2,416) = 2.28					*F* (6,412) = 12.86**					*F* (8,410) = 9.64**					*F* (9,409) = 8.63**				

	Model 1					Model 2					Model 3					Model 4				
Performance Prediction: Middle of academic year (N = 221)																				
	B	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**	
Age	.009	.006	.100	-.003	.020	.009	.005	.099	-.002	.019	.010	.005	.115	.000	.020	.009	.005	.108	-.001	.020
Biological sex	.012	.115	.007	-.215	.238	.012	.103	.007	-.191	.214	.004	.102	.002	-.197	.205	-.010	.103	-.006	-.213	.192
Self-efficacy						**.395****	**.066**	**.383**	**.266**	**.524**	**.405****	**.066**	**.393**	**.274**	**.536**	**.383****	**.069**	**.371**	**.247**	**.520**
Control						.052	.055	.057	-.057	.161	.062	.055	.068	-.046	.171	.058	.055	.063	-.051	.167
Approach Goals						**.171***	**.055**	**.224**	**.062**	**.280**	**.179****	**.055**	**.234**	**.070**	**.287**	**.202****	**.059**	**.266**	**.086**	**.319**
Avoidance Goals						-.082	.044	-.136	-.168	.004	-.077	.043	-.128	-.163	.009	-.073	.044	-.121	-.159	.013
Social Support											.019	.039	.029	-.058	.095	.024	.039	.038	-.053	.101
University Identity											**-.084***	**.036**	**-.143**	**-.156**	**-.013**	**-.079**	**.037**	**-.133**	**-.151**	**-.007**
Irrational Beliefs																-.105	.092	-.081	-.287	.076
Adjusted R^2 (R^2 change)		.001 (Δ R^2 =.010)					.232** (Δ R^2 =.243**)					.244 (Δ R^2 =.019)					.245 (Δ R^2 =.004)			
ANOVA		*F* (2,218) = 1.09					*F* (6,214) = 12.09**					*F* (8,212) = 9.89**					*F* (9,211) = 8.95**			
Performance Prediction: End of academic year (N = 141)																				
	B	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**	
Age	.009	.008	.106	-.006	.025	.004	.007	.050	-.009	.018	.005	.007	.059	-.009	.019	.006	.007	.071	-.008	.021
Biological sex	.100	.160	.053	-.216	.416	.069	.144	.037	-.216	.354	.034	.146	.018	-.255	.323	.049	.147	.026	-.241	.340
Self-efficacy						**.466****	**.084**	**.451**	**.301**	**.632**	**.530****	**.094**	**.512**	**.344**	**.715**	**.546****	**.095**	**.528**	**.358**	**.734**
Control						.076	.075	.077	-.072	.224	.070	.075	.071	-.078	.218	.076	.075	.077	-.072	.224
Approach Goals						.069	.075	.086	-.079	.216	.076	.075	.096	-.073	.225	.049	.080	.061	-.109	.207
Avoidance Goals						-.041	.068	-.059	-.176	.093	-.040	.068	-.058	-.175	.094	-.062	.071	-.089	-.203	.079
Social Support											-.048	.052	-.075	-.150	.055	-.048	.052	-.076	-.151	.054
University Identity											-.050	.044	-.091	-.138	.038	-.057	.045	-.104	-.146	.032
Irrational Beliefs																.127	.123	.102	-.116	.370
Adjusted R^2 (R^2 change)		.001(Δ R^2 =.015)					.227** (Δ R^2 =.245**)					.229 (Δ R^2 =.012)					.229 (Δ R^2 =.006)			
ANOVA		*F* (2,138) = 1.04					*F* (6,134) = 7.86**					*F* (8,132) = 6.19**					*F* (9,131) = 5.62**			

*Note: *p < .05, **p < .001; Females were coded 1, and males were coded 2.*

*Table 3.4: Fixed effects hierarchical regression analyses predicting wellbeing and predicted performance at the middle, and end of the academic year with predictors from the beginning and middle of the academic year. Note: *p < .05, **p < .001.*

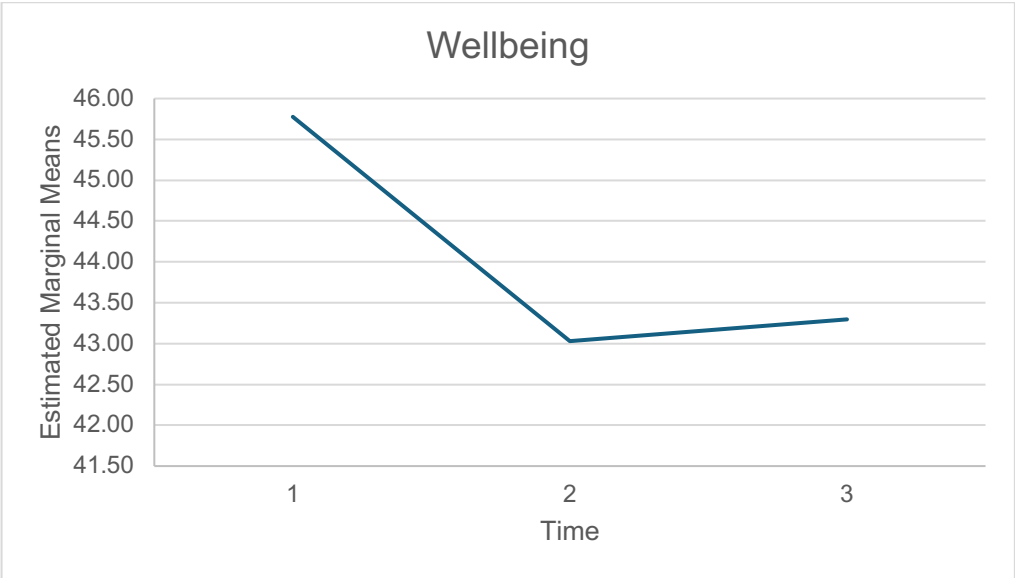
	Model 1	Model 2				Model 3					Model 4				
Wellbeing															
		B	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**	
Dummy variables																
Self-efficacy		**2.556****	**.754**	**.202**	**1.071**	**4.040**	**2.325***	**.736**	**.184**	**.876**	**3.775**	**2.178***	**.732**	**.172**	**.736**	**3.620**
Control		.957	.593	.083	-.212	2.125	.942	.574	.081	-.188	2.072	.914	.569	.079	-.206	2.034
Approach Goals		-.055	.605	-.006	-1.247	1.136	-.219	.586	-.023	-1.374	.936	.113	.598	.012	-1.066	1.291
Avoidance Goals		-.427	.454	-.058	-1.321	.467	-.324	.440	-.044	-1.190	.542	-.172	.441	-.023	-1.040	.695
Social Support							**2.190****	**.575**	**.283**	**1.059**	**3.322**	**2.148****	**.570**	**.277**	**1.025**	**3.270**
University Identity							.702	.454	.093	-.192	1.595	.747	.450	.099	-.139	1.633
Irrational Beliefs												**-2.649***	**1.132**	**-.170**	**-4.880**	**-.418**
Adjusted R^2 (R^2 change)	.599** (Δ R^2 =.878**)			.619* (Δ R^2 =.008*)			.644** (Δ R^2 =.008**)					.651* (Δ R^2 =.002*)				
ANOVA	*F (576,251)* = 3.14**			*F (580,247)* = 3.32**			*F (*582,245) = 3.57**					*F (*583,244) = 3.64**				
Predicted Performance																
		B	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**	
Dummy Variables																
Self-efficacy		**.222***	**.070**	**.218**	**.083**	**.360**	**.205***	**.071**	**.202**	**.065**	**.344**	**.212***	**.071**	**.209**	**.072**	**.352**
Control		-.051	.056	-.055	-.162	.059	-.052	.056	-.057	-.163	.058	-.052	.056	-.057	-.163	.058
Approach Goals		**.133***	**.057**	**.174**	**.021**	**.246**	**.126***	**.057**	**.165**	**.013**	**.238**	.109	.059	.143	-.007	.226
Avoidance Goals		-.038	.043	-.065	-.123	.046	-.040	.043	-.069	-.125	.044	-.047	.043	-.080	-.133	.038
Social Support							-.010	.055	-.016	-.119	.099	-.006	.055	-.010	-.115	.103
University Identity							.079	.044	.132	-.007	.165	.076	.044	.127	-.010	.163
Irrational Beliefs												.125	.112	.100	-.096	.347
Adjusted R^2 (R^2 change)	.457** (Δ R^2 =.836**)			.489** (Δ R^2 =.012**)			.492 (Δ R^2 =.002)					.492 (Δ R^2 =.001)				
ANOVA	*F (*561,243) = 2.21**			*F (*565,239) = 2.36**			*F (*567,237) = 2.37**					*F (*568,236) = 2.37**				

3.3.4. Phase 4: Analyses of variance across timepoints (H4).

Variance in Wellbeing

A total of N = 67 participants completed the wellbeing measure at all three time-points of the study. A one-way repeated measures ANOVA was conducted to determine whether there was a statistically significant change in self-reported wellbeing, measured at the start, middle and end of the academic year. The assumption of sphericity was not met, as assessed by Mauchly's test of sphericity, $\chi2(2) = 7.498$, $p = .024$. Therefore, a Greenhouse-Geisser correction was applied ($\varepsilon = 0.902$). Changes in participants' wellbeing from the start ($M = 45.78$, $SD = 11.5$) to the middle ($M = 43.03$, $SD = 11.28$), and to the end ($M = 43.3$, $SD = 12.34$) of the academic year, were statistically significant $F(1.804,119.032) = 3.35$, $p = .043$, partial $\eta^2 = .094$. Post hoc analysis with a Bonferroni adjustment revealed that wellbeing decreased significantly from the start to the middle of the academic year ($M = 2.746$, 95% CI [0.145, 5.348], $p = .035$), but not from middle to end ($M = 0.269$, 95% CI [-2.92, 2.383], $p = 1$), and not from the start to the end ($M = 2.478$, 95% CI [-0.836, 5.791], $p = .212$).

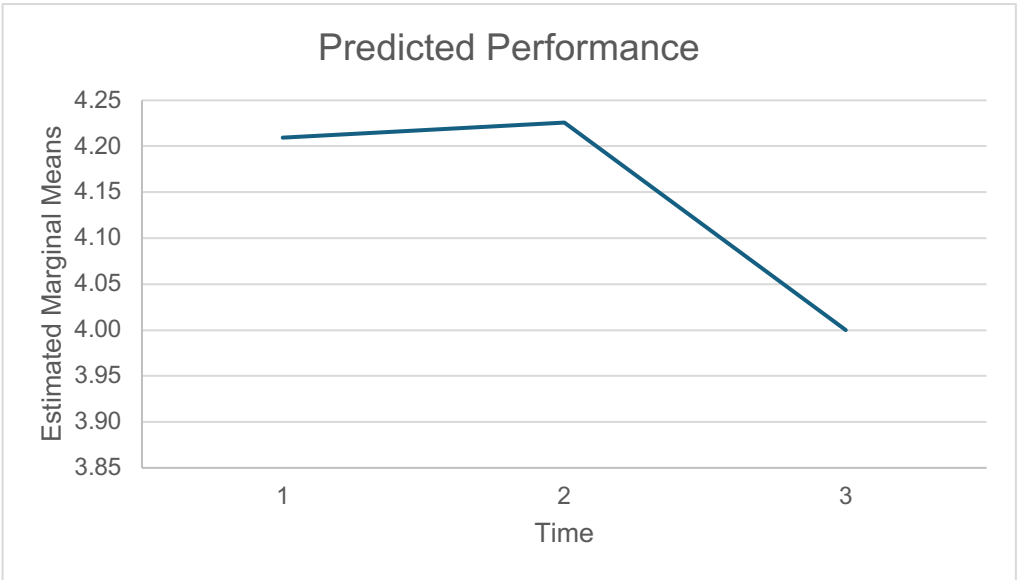
Figure 3.5: Changes in student Wellbeing form timepoint 1 (start), to 2 (middle), and 3 (end) of the academic year.



Variance in Predicted Performance

A total of N = 62 participants completed the predicted performance measure at all three time points of the study. A one-way repeated-measures ANOVA was conducted to determine whether there was a statistically significant change in self-reported predicted performance, measured at the start, middle, and end of the academic year. The assumption of sphericity was not met, as assessed by Mauchly's test of sphericity, $\chi2(2) = 15.213$, $p < .001$. Therefore, a Greenhouse-Geisser correction was applied ($\varepsilon = 0.817$). Changes in participants predicted performance from the start ($M = 4.21$, $SD = .70$) to the middle ($M = 4.23$, $SD = .84$), and to the end ($M = 4$, $SD = .96$) of the academic year, were statistically significant $F(1.634,99.676) = 2.768$, $p = .078$, partial $\eta^2 = .043$. Post hoc analysis with a Bonferroni adjustment revealed that predicted performance did not change significantly between the start and middle of the academic year ($M = -.016$, 95% CI [-0.285, 0.252], $p = 1$) or from the start to the end ($M = .21$, 95% CI [-0.101, 0.52], $p = .306$). However, predicted performance changed significantly from the middle to the end of the academic year ($M = .226$, 95% CI [0.026, 0.425], $p = .021$).

Figure 3.6: Changes in students' Predicted Performance from timepoint 1 (start), to 2 (middle), and 3 (end) of the academic year.



Variance in task resource appraisals

A total of N = 65 participants completed the task-relevant resource appraisals measures (self-efficacy, control, approach goals and avoidance goals) at all three time-points of the study. A within-subjects repeated measures MANOVA was conducted to determine whether there was a statistically significant change in resource appraisals measured at the start, middle and end of the academic year. The data met assumptions for internal linearity assumption and no multicollinearity was detected was present as assessed by Pearson's correlation matrix. The assumption of sphericity was met by met for measures of self-efficacy, approach goals and avoidance goals (p > .05), however the data for control did not meet sphericity assumptions as assessed by Mauchly's test of sphericity, $\chi2(2) = 12.589$, $p = .002$. Therefore, a Greenhouse-Geisser correction was applied ($\varepsilon = 0.847$).

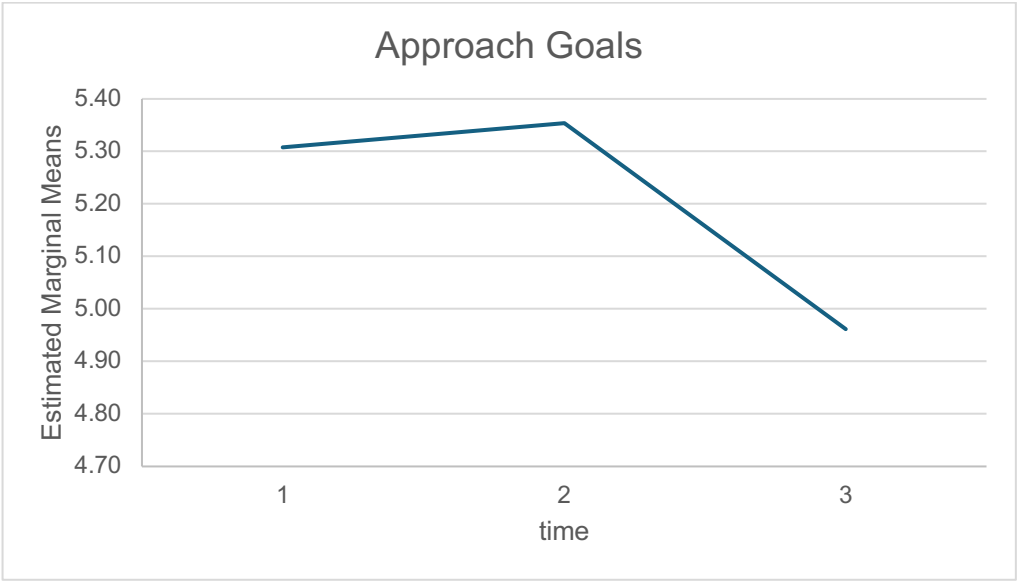
There was no statistically significant effect of time on the combined resource appraisals, $F(8, 57) = 2.078$, $p = .053$, Wilks' $\Lambda = .774$, partial $\eta^2 = .226$. Univariate tests revealed no statistically significant effect of time on self-efficacy, control and avoidance goals (p >.05). A statistically significant effect of time on approach goals was observed, $F(2, 128) = 5.348$, $p = .006$, partial $\eta^2 = .077$. With the model p value close to statistical significance, post hoc analyses were completed tentatively.

Post hoc analysis of the pairwise comparisons for approach goals with a Bonferroni adjustment revealed that approach goals did not change significantly from the start to the middle of the year (M = -.046, 95% CI [-0.369, 0.277], $p = 1$), however they did decrease significantly from the middle to the end (M = .392, 95% CI [0.073, 0.712], $p = .011$) and from the start to the end of the academic year (M = .346, 95% CI [0.022, 0.671], $p = .033$).

Table 3.4: Means, standard deviations and 95% confidence interval for means of participants' confidence, control, goal orientation and perceived availability of social support, measured at the start, middle and end of the academic year.

Variable	Timepoint	N=65		95% Confidence Interval for Mean	
		M	*SD*	*Lower Bound*	*Upper Bound*
Self-efficacy	1. Start	3.35	.10	3.145	3.562
	2. Middle	3.27	.12	3.023	3.515
	3. End	3.35	.12	3.119	3.588
Control	Baseline	4.48	.12	4.241	4.713
	Post session	4.45	.10	4.241	4.652
	Follow-up	4.55	.08	4.396	4.712
Approach Goals	Baseline	5.31	.13	5.057	5.558
	Post session	5.35	.14	5.081	5.627
	Follow-up	4.96	.12	4.725	5.198
Avoidance Goals	Baseline	4.71	.17	4.365	5.050
	Post session	4.46	.15	4.167	4.756
	Follow-up	4.35	.16	4.018	4.675

Figure 3.7: Changes in students' Approach Goals form timepoint 1 (start), to 2 (middle), and 3 (end) of the academic year.

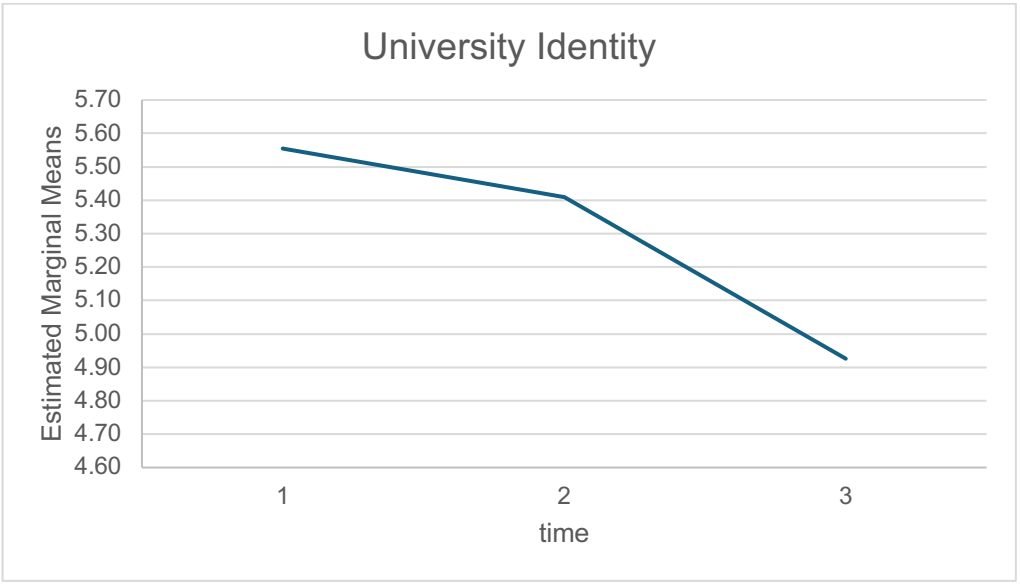


Variance in university identity

A total of N = 64 participants completed the university identity measure at all three-time points of the study. A one-way repeated measures ANOVA was

conducted to determine whether there was a statistically significant change in university identity, measured at the start, middle and end of the academic year. The assumption of sphericity was not met, as assessed by Mauchly's test of sphericity, $\chi2(2) = 12.261$, $p = .002$. Therefore, a Greenhouse-Geisser correction was applied ($\varepsilon = 0.848$). Changes in participants' university identity from the start ($M = 5.55$, $SD = 1.37$) to the middle ($M = 5.41$, $SD = 1.33$), and to the end ($M = 4.96$, $SD = 1.67$) of the academic year, were statistically significant $F(1.696,106.832) = 10.141$, $p < .001$, partial $\eta^2 = .139$.
Post hoc analysis of the pairwise comparisons for university identity with a Bonferroni adjustment revealed that identity did not change significantly from the start to the middle of the year ($M = .145$, 95% CI [-0.155, 0.444], $p = .717$). However, university identity decreased significantly from the middle to the end ($M = .484$, 95% CI [0.142, 0.826], $p = .003$) and from the start to the end of the academic year ($M = .629$, 95% CI [0.202, 1.055], $p = .002$).

Figure 3.8: Changes in students' social identification with the university, from timepoint 1 (start), to 2 (middle), and 3 (end) of the academic year.



Variance in Irrational Performance Beliefs

A total of N = 64 participants completed the irrational performance beliefs measure at all three time points of the study. A one-way repeated measures ANOVA was conducted to determine whether there was a statistically significant change in university identity, measured at the start, middle and

end of the academic year. The assumption of sphericity was met, as assessed by Mauchly's test of sphericity, $\chi2(2) = .957$, $p = .255$. Changes in participants' irrational performance beliefs from the start ($M = 3.27$, $SD = 0.7$) to the middle ($M = 3.28$, $SD = 0.62$), and to the end ($M = 3.15$, $SD = 0.76$) of the academic year, were not statistically significant $F(2,126) = 2.396$, $p = .095$, partial $\eta^2 = .037$.

Variance in Social Support

A total of N = 64 participants completed the multidimensional perceived social support measure at all three time points of the study. A one-way repeated measures ANOVA was conducted to determine whether there was a statistically significant change in university identity, measured at the start, middle and end of the academic year. The assumption of sphericity was not met, as assessed by Mauchly's test of sphericity, $\chi2(2) = .858$, $p = .009$. Therefore, a Greenhouse-Geisser correction was applied ($\varepsilon = 0.876$). Changes in participants' irrational performance beliefs from the start ($M = 4.98$, $SD = 1.33$) to the middle ($M = 4.99$, $SD = 1.43$), and to the end ($M = 4.85$, $SD = 1.48$) of the academic year, were not statistically significant $F(1.752,110.373) = .854$, $p = .415$, partial $\eta^2 = .013$.

3.4. Discussion

The purpose of the present study was to address the first and second aims of this thesis by investigating the role of challenge and threat resource appraisals, social resources and irrational performance beliefs on HE students' wellbeing and predicted performance across an academic year.

3.4.1. Summary of findings

Findings on student wellbeing

The results of the current study offer consistent cross-sectional support (analysis phase two) at each of the three timepoints for the hypothesised positive influence of the resource appraisal for self-efficacy (H1), the positive influence of the social resource for social support (H2a), and negative influence of irrational beliefs (H3) on greater student wellbeing. Moreover, the fixed effects regression results demonstrate that these influences are stable across time (analysis phase three). The remaining resource appraisals (control, approach and avoidance goals; H1) influence on wellbeing received mixed support over time. More specifically with the decline in sample size (i.e., statistical power) from 423 to 147, the resource appraisals (excluding self-efficacy) were no longer significant predictors of student wellbeing. Contrary to hypothesised (H2b), university identity failed to predict student wellbeing at all three timepoints of the study. Finally, the explorative analysis of wellbeing changes across the academic year (H4), revealed that students' wellbeing declined significantly from the start to the middle of the academic year and then remained stable to the end of the academic year at its new lower level. These findings suggest that students who have high self-efficacy in their studies, high availability of multidimensional social support and low levels of irrational performance beliefs, are more likely to experience better wellbeing across the academic year. Notably, the addition of social support in the analysis consistently changed ß values of all resource appraisals, suggesting some shared explained variability between resource appraisals and social support, in other words, an interaction between the predictors.

Findings on predicted performance

The results offer consistent support at each of the three timepoints for the hypothesised influence of the resource appraisal for self-efficacy (H1) on predicted performance. This pattern (support for self-efficacy; H1) was also supported by the fixed effects regression analysis. Additionally, there was some partial support at two timepoints (start and middle) for the hypothesised influence of the resource appraisal for approach goals (H1) on predicted performance, which was also partially supported in the fixed effects analysis. However, at the final timepoint of the study (end of academic year) and in the final model of the fixed effects regression, approach goals were no longer a significant predictor of predicted performance. Similarly, the resource appraisal for avoidance goals (H1) demonstrated influence on predicted performance, in the hypothesised direction, in the presence of high participant numbers (statistical power) at the first timepoint (start of the academic year). In opposition to hypothesised (H2b), university identity exerted a negative influence on predicted performance (contrary to existing evidence, e.g., Wilkins et al., 2015), as seen in the regression analysis of the data from the middle of the academic year, only. Hypothesis three (H3) was not supported; irrational performance beliefs did not predict performance. Finally, the explorative analysis of predicted performance changes across the academic year (H4) revealed that students' predicted performance was stable between the start and middle of the academic year. It later declined significantly between the middle and end of the academic year. These findings suggest that students who have high self-efficacy (H1) in their studies, potentially accompanied by high approach goals (H1) are likely to have a more positive outlook on their academic performance. Additionally, the observed changes in predicted performance across the year may be the result of adjustments based on having received actual grades in the second semester.

Observed changes in resource appraisals, social resources and irrational performance beliefs

The explorative analysis of how the independent variables changed during the academic year (H4) presented interesting patterns. First, resource

appraisals were stable throughout the academic year, suggesting that students' academic self-efficacy, control and achievement goals did not change as a result of their studies across the academic year. This is contrary to trends observed in the literature, where resource appraisals are portrayed as changeable. This holds relevance for applied performance psychology practices aimed at enhancing resource appraisals. Second, students' university identity declined significantly as the academic year progressed, suggesting that students identified with their university less despite spending more time at university. Finally, students' perceived social support and irrational performance beliefs remained stable across the academic year. This finding is unsurprising as these were measured at the trait level and are expected to be stable.

3.4.2. Interpretation of findings based on the literature

The present study findings have partial alignment with existing literature. For example, resource appraisals for self-efficacy consistently predicted both wellbeing and performance in alignment with TCTSA predictions (Jones et al., 2009). However, the remaining resources, originally proposed to function together with self-efficacy (Jones et al., 2009), did not produce the same consistent predictive influence. This is aligned with observations from TCTSA-R (Meijen et al., 2020), which raises a key critique about the mixed evidence related to challenge and threat resource appraisals. The potential applicability of universal challenge and threat resources (with the exclusion of self-efficacy) can be questioned based of the findings of this study.
Next, the predicted integration of social support and social identity into challenge and threat theory (Meijen et al., 2020) was partially supported. Where social identity research has observed an impact of identity on performance (Miller et al., 2021; Slater et al., 2018) and wellbeing (Pedler et al., 2021) in a motivated performance setting and challenge and threat appraisals. Instead, multidimensional perceived social support successfully predicted student wellbeing, but failed to predict performance, at all three timepoints of the study. As such the predictive ability of social support on wellbeing (Green et al., 2021; Kotyśko & Frankowiak, 2025; Mishra, 2020;) is

consistently demonstrated by the present study results. Despite the lack of observed support for social identity in the current study, literature has successfully observed a positive influence on motivating others for action and effective exchange of support (Haslam et al., 2005; Frisch et al., 2014). The mixed evidence suggests that methodological differences may be considered for their potential influence on results, otherwise it is likely that existing understanding of the influence of social identity of HE students requires further research and theoretical development.

A similar pattern was observed for the integration of irrational beliefs into challenge and threat theory (Meijen et al., 2020). Irrational beliefs were found to predict student wellbeing in alignment with the literature (Banks, 2011; Choi & Kim, 2008; Wong, 2008) but misaligned on predicting student performance (Everson & Terjesen, 2023; Meijen et al., 2020; Turner et al., 2024). This study observed that student's irrational performance beliefs negatively predict wellbeing but not performance. One potential explanation comes from the correlations observed between student wellbeing and performance, suggesting that it would be advantageous to consider these variables together and explore how they interact. For example, analysis utilising structural equation modelling (e.g., Malkoc et al., 2023) can consider multiple outcome variables within the same analysis. Notably, a large sample would be required to model the suggested interactions.

3.4.3. Strengths and Limitations

The current study benefits from several strengths. First, the university wide repeated measures research design is rare in the literature. Here it allows for the repeated testing of the theoretical model concepts, re-affirming the hypothesised connections. For example, where previous research offers mixed support for the role of challenge and threat resource appraisals (Meijen et al., 2020), variability of study designs and analysis prevent the drawing of direct parallels. The current study, however, can be considered as including its own research study replications. More specifically, the same cross-sectional study ran three times in one academic year, with time being the main variable change. Second, despite not reaching sufficient repeated

participant numbers, the three timepoints of the study benefit from sufficient statistical power for repeated cross-sectional analysis. Additionally, the inclusion of the fixed effect regression analysis tests the stability of the results across time reveals the same patterns of explained variability in the dependent variables, enhancing the validity of the findings.

Third, the study brings together irrational beliefs and social resources as suggested in the revised TCTSA-R (Meijen et al., 2020). Where both concepts are receiving increasing interest for their relation to challenge and threat responding, they have rarely been researched together (e.g., Choi & Kim, 2008; Dixon et al., 2017). The present study brings together social resources and irrational beliefs to study their influence on challenge and threat resource appraisals, wellbeing and predicted academic performance in HE students. The inclusion of these variables at the later steps of the regression analysis, allows for isolating their statistical influence on the dependent variables and changes of the individual regression model ß values. For example, the inclusion of irrational beliefs in predicting wellbeing at the beginning of the academic year, resulted in avoidance goals no longer presenting as a significant predictor, indicating shared explained variability.

Despite the current findings, the present research is not without limitations which offers ideas for future research. Establishing causality from repeated measures cross-sectional studies is still subject to compounding error probability, from the use of multiple statistical tests. This can be mediated by using larger samples and more sophisticated analysis methods (e.g., structural equation modelling). Additionally, the a-temporal regression analysis employed here does not isolate the influence of each independent variable with shared variability added to variables added at later steps. This means that variables added at step three and four (social resources and irrational beliefs), include the shared explained variability from variables added at earlier steps (psychological resources). Future repeated measures cross-sectional research into a biopsychosocial approach to understanding HE student wellbeing and performance should consider more sophisticated analysis methods (e.g., structural equation modelling).

Also, the current study has several methodological limitations. Firstly, failing to measure affect (positive and negative emotions) presents critical limitation

based on published research from Malkoc and colleagues (2023) who found that challenge and threat appraisals exert influence on performance via affect (note: this limitation is addressed in Chapter 4). Second, the measure of social support utilised specifically measured students perceived available sources of social support such as family, friends and important others. In doing so, the study's ability to generate suggestions for future interventions is limited by contextual factors. For example, knowing that family support is important for student wellbeing may indicate individual specific interventions, but these would not be easily expanded to universally applicable interventions due to the individual differences in family context. As such the next two studies in this thesis will adopt a different measure for social support and instead consider the four dimensions of social support (i.e., emotional, esteem, informational, and tangible; Rees et al., 1999). Third, due to the nature of university-wide research, the current study could not test the 'bio' element of the suggested biopsychosocial approach in chapter one. Chapter 4 (study 2) will address this and other limitations by making key methodological changes. For example, a cohort level approach will allow for cardiovascular challenge and threat data collection (HR, CO and TPR measures), in response to academic assessment, alongside grades and emotional valence.

3.4.4. Conclusion

The current chapter and study addressed the first and second aims of this thesis. This investigation into the influence of challenge and threat resource appraisals, social resources and irrational performance beliefs on HE students' wellbeing and predicted performance across an academic year highlighted key psychosocial interactions. Namely, that self-efficacy plays a key role in both student wellbeing and predicted academic performance. Additionally, whilst perceived high social support availability alongside low prevalence of irrational beliefs are conducive to greater student wellbeing, these may not be directly influential towards better academic performance predictions. Finally, contrary to expectations, students identified less with

their university as the academic year progressed, and their university identity was a negative predictor of predicted academic performance.

The next chapter and study will aim to expand on the findings of this chapter by addressing some of the key limitations. Biological measures of challenge and threat (i.e., cardiovascular reactivity measures) alongside affect and acute assessment performance (grades achieved on a presentation assessment) will be incorporated to achieve an integrated biopsychosocial examination of students' challenge/threat responses and relate these to their wellbeing and academic performance.

Chapter 4. The impact of psycho-social resources on challenge and threat states, wellbeing and academic performance in a cohort of university students: an experimental study

4.1. Introduction

Chapter one outlined theory and research on how stress influences psycho-physiological reactivity (challenge/ threat responses) and the resultant influence on wellbeing and performance in a motivated performance environment. The narrative detailed the role of personal (self-efficacy, control and achievement goals) and social (support and identity) resource appraisals along with cognitive predispositions (irrational beliefs) as antecedents to challenge and threat responses. Next, Chapter 3 addressed the first and second aims of this thesis from a psychosocial perspective. The repeated measures, university-wide research design of chapter 3 highlighted that the challenge/threat resource appraisals, social resources and cognitive predispositions are significant predictors of student wellbeing and predicted overall performance for the academic year. In doing so, the second chapter partially addressed the first and second aims of this thesis, except for the biological component of challenge and threat theory. The present chapter will expand the first and second aims of this thesis by incorporating a biological component (introduced in chapter one) alongside the validated psychosocial antecedents of challenge and threat (as discussed in chapter 3). Furthermore, the current chapter will apply the suggested biopsychosocial formulation of TCTSA-R (Meijen et al., 2020) to the acute cardiovascular challenge/threat response of students in the context of a real-life graded presentation assessment. In doing so, the research in this chapter will present a biopsychosocial examination of students' responses to academic assessment, wellbeing and academic achievement (grades).

Three systematic reviews uncovered a small but stable performance predictive effect of physiological markers of challenge and threat, supporting the validity of utilising both physiological and appraisal measures, and present themselves across performance contexts (Behnke & Kaczmarek, 2018; Hase et al., 2019; 2025). As discussed in chapter one, challenge and threat research has consistently utilised students as lab participants (e.g. Slater et al., 2018). Still, only a few studies have applied challenge and threat theory to students' responses and experiences in Higher Education (HE; e.g., Smith et al., 2022). The stress experienced by students in the context of their studies has been evidenced to have an impact on their academic performance. In academia, Seery and colleagues (2010) found that challenge and threat responses to delivering a talk on one's academic interests were predictive of course scores. The current study adopts a similar perspective, i.e., that students' cardiovascular responses to their assessment will relate to their performance in the assessment. Importantly, previous challenge and threat research has measured cardiovascular responses days, weeks, and even months ahead of performance and found responses to be related to performance in a motivated performance environment (e.g., Chadha et al., 2019, 2023; Seery et al., 2010). To build on this, the current study examines participants' cardiovascular responses in close temporal proximity to the performance event, more specifically, students' cardiovascular response is measured within 90 minutes of them presenting for their assessment.

Additionally, the key components of resource appraisals (Jones et al., 2009), social resources (Meijen et al., 2020) and irrational beliefs (Chadha et al., 2019; Turner et al., 2024) from chapter tw are carried forward and examined in the current study. Where these are measured by state measures (e.g., self-efficacy), the wording has been adapted to the context. For example, in chapter 3, students were asked to rate "To what extent do you feel confident that you can perform well within your studies?" In the current study, this is adapted to the assessment context. Students are asked to rate "To what extent do you feel confident that you can perform well on this assessment?". To avoid repetition, the following introduction addresses the concepts that

differ from chapter 3, namely cardiovascular challenge and threat responses, affect, and the four types of social support.

4.1.1. Stress and performance in HE

The idea of stress traces its origins back to ancient Greek philosophical conceptualisations and the foundational work of early experimental medicine (Bernard, 1865; Cannon, 1929; Selye, 1936; 1976). These early investigations laid the groundwork for understanding stress from a physiological perspective, which later evolved to encompass cognitive and social dimensions (Lazarus & Folkman, 1984; Meijen et al., 2020). This convergence of physiological, psychological, and social perspectives has culminated in a comprehensive theory of challenge and threat responses, particularly within motivated performance environments (Blascovich & Mendes, 2000; Blascovich & Tomaka, 1996). In motivated performance contexts, an individual's response to stress can be examined through biological, psychological, and social lenses.

Physiological markers of activation, such as neuro-endocrine and cardiovascular activity, can be observed in the first seconds of a motivated performance situation becoming salient, resulting in the release of catecholamines and an increase in heart rate (HR; Blascovich, 2008; Dienstbier, 1989). From here, a challenge state is characterised by increased HR, stable or decreased total peripheral resistance (TPR) in the blood vessels and increased cardiac output (CO). This increase in CO (i.e. blood following for more oxygen and glucose to be circulated to the brain and muscle groups, setting the scene for optimal and/or adaptive responding. By contrast, a threat state is characterised by increased HR and TPR, stable or decreased CO, where the lack of blood flow increase deprives the brain and muscles of the necessary oxygen and glucose for optimal responding (Dienstbier, 1989).

Psychologically, challenge and threat responses are conceptualised as affect where they represent the arousal of emotion and the related motivation to take directed action (behaviour), either towards or away from what arouses the emotion (Jones, 1995). The physiological presentation (HR, CO, and

TPR) of emotional arousal in the body is often accompanied by matching self-reports of emotional experiences (Mendes & Park, 2014). Responding from this perspective is a psycho-physiological attempt to meet the demands of, or to reduce the negative consequences of a personally important or stressful situation (Lazarus, 1991). Therefore, a challenge state is where the individual is likely to respond effectively and experience a higher sense of wellbeing, growth and development (Lazarus, 1991); whereas a threat state is more likely associated with harm or loss (Lazarus & Folkman, 1984).
Finally, the social predispositions, namely social support availability and a shared social identity between support provider and recipient, have been evidenced to influence challenge/threat responses (Brown & Fletcher, 2017; Miller et al., 2021; Slater et al., 2018). One way social support buffers against stress is via the type of supportive interactions that may lead to enhanced appraisals of resource availability (Bianco & Eklund, 2001). Four types of social support have been evidenced to have an impact on performance directly and indirectly. These are: (1) emotional support (e.g., feeling cared for and comforted); (2) esteem support (e.g., sense of competency and ability is bolstered); (3) informational support (e.g., direct advice and guidance); and (4) tangible support (e.g., concrete assistance with task execution; Freeman et al., 2011). Beyond the impact on performance (Martínez-López et al., 2023), social support in the context of a shared social identity can have a stress buffering effect on the recipient's wellbeing in occupational, sporting and academic settings (Gillman et al., 2023; Hartley & Coffee, 2019; Mitchell et al., 2013; Zwettler et al., 2018).
Social support presented as an important predictor for student wellbeing in chapter 3, highlighting the benefits of having a multidimensional social support network (family, friends and important other; Mishra, 2020). To deepen our understanding of the mechanisms via which these sources of social support impact student wellbeing and performance, the current chapter will examine the four types of social support (Freeman et al., 2011). More specifically how they impact on student's assessment performance, wellbeing and overall challenge/threat responding from a biopsychosocial perspective. For example, existing research has highlighted the positive influence of emotional support on students' capacity for coping with

academic stress and greater wellbeing (Green et al., 2021). In turn, high levels of esteem support have been associated positively with better sporting performance via perceptions of control and challenge appraisals (Freeman & Rees, 2009). Finally, a systematic review investigating the impact of social support on cardiovascular stress reactivity found a significant main effect of social support, especially in highly engaging tasks (i.e., motivated performance; Teoh & Hilmert, 2018).

In summary, physiologically, challenge and threat states are identified by an increase in neuro-endocrine and cardiovascular activity (e.g., an increase in adrenalin levels and heart rate). Psychologically challenge and threat responses differ from one another in emotional valence and behavioural responses. Finally, the social context can present as a predisposing factor to challenge/threat responding. Building on the psychological and social concepts explored in the preceding chapters, this chapter seeks to extend the findings by integrating the biological and emotional components of challenge and threat theory, thereby offering a more holistic understanding of students' responses to the motivated performance environment of HE.

4.1.2. The present study aims and design

The present study aimed to examine the bio-psycho-social antecedents of student wellbeing and performance on academic assessment (aims one and two of this thesis). More specifically, this study investigated the influence of challenge and threat responses and resource appraisals (Jones et al., 2009), social and psychological predispositions (Meijen et al., 2020) on students' self-reported wellbeing, affect, and presentation assignment performance. The study tested the integration of social resources (perceived social support availability and social identity) and cognitive predispositions (irrational beliefs) into the TCTSA (a biopsychosocial approach), by testing their influence on resource appraisals, challenge and threat cardiovascular responses, student wellbeing and academic performance. This study adopts a field-based experimental research design, where the integrated biopsychosocial approach is utilised towards predicting student self-reported wellbeing and academic performance.

The following hypotheses will be tested:

H1. High personal resource appraisals (i.e., self-efficacy, control, achievement goals) will be associated with a challenge (as opposed to threat) response, greater wellbeing, and performance expectations in motivated performance.

H2. High social resource appraisals (i.e., social support and social identity):

H2a) Students' perceived social support will be associated with challenge (as opposed to threat) response, greater student wellbeing, as well as higher performance expectations and higher presentation assessment grades.

H2b) Students' social identification with the university will be associated with challenge (as opposed to threat) response, greater influence on student wellbeing as well as higher performance expectations and assessment grades.

H3. Irrational performance beliefs will be associated with threat (as opposed to challenge) response, poorer performance predictions, assessment and wellbeing.

H4. A cardiovascular challenge (as opposed to threat) response will be conducive to better students' performance (assessment grades), associate with higher resource appraisals, favourable social and personal predispositions, wellbeing and affect (Jones et al., 2009; Meijen et al., 2020).

The following study analysis and results will be structured and presented based on the key outcome variables:

Experiences (self-reported wellbeing, positive and negative affect): Based on existing literature, high task-relevant resource appraisals (self-efficacy, control, approach goals and avoidance goals) are expected to contribute positively to students' wellbeing and positive and negative affect (H1; positive and negative affect; Allen et al., 2017; Chapter 2 of current thesis; Jones et al., 2009). Additionally, perceived social support availability and a social identity with the university institution are expected to contribute positively to students' wellbeing) and positive and negative affect (H2; Allen et al., 2017;

Levens et al., 2016; Scanlon et al., 2020; Shumaker & Brownell, 1984). Finally, high prevalence of irrational performance beliefs is expected to contribute negatively to students' wellbeing and positive and negative affect (H3; Choi & Kim, 2008; Turner et al., 2024; Wong, 2008).

Performance (self-predicted performance and assessment grades): Based on existing literature, high task-relevant resource appraisals (self-efficacy, control, approach goals and avoidance goals) are expected to contribute positively to students' performance (H1; Jones et al., 2009; Malkoc et al., 2023). Additionally, perceived social support availability and a social identity with the university institution are expected to contribute positively to students' performance (H2; Freeman & Rees, 2010; Mishra, 2020; Slater et al., 2018). Finally, high prevalence of irrational performance beliefs is expected to contribute negatively to students' performance (H3; Chadha et al., 2019, 2023; Everson & Terjesen, 2023; Meijen et al., 2020; Turner et al., 2024).

Cardiovascular challenge and threat response: Based on existing motivated performance literature, students are expected to respond to academic assessment with a challenge/threat response. More specifically, an increase in HR from baseline to task, accompanied by an increase or decrease in CO and/or TPR. Additionally, high task-relevant resource appraisals (self-efficacy, control, approach goals and avoidance goals) are expected to contribute positively to students' CO response and negatively to their TPR response (H1; Jones et al., 2009). Next, perceived social support availability and a social identity with the university institution are expected to contribute positively to students' CO response and negatively to their TPR response (H2; Meijen et al., 2020). Finally, high prevalence of irrational performance beliefs is expected to contribute negatively to students' CO response and negatively to their TPR response (H3; Meijen et al., 2020).

Exploring differences between challenge and threat responders (H4): Based on existing motivated performance literature, students' challenge responses are expected to co-occur in alignment with high resource appraisals (H1; Jones et al., 2009), social and personal predispositions (H2 and H3; Meijen et al., 2020), positive and negative affect (H4; Malkoc et al., 2023). More specifically, students who respond to the assessment with a

cardiovascular challenge response are expected to outperform those who respond with a cardiovascular threat response (H4; Blascovich et al., 2004).

4.2. Methodology

4.2.1. Study design

This research was an experimental, field-based design to study naturally occurring cardiovascular challenge and threat states, academic achievement, wellbeing and positive and negative affect of university students in the context of course assessment. Students attended a laboratory session up to 90 minutes prior to presenting on a graded presentation assessment (part of their course). In the lab, participants completed the pack of psychometrics and engaged with an audio-visual presentation consisting of their assessment instructions and a mental preparation task. Students then went on to present for their assessment (as per their module processes) and their academic board-confirmed grades for the presentation assessment were added to their data set.

4.2.2. Participants

The sample size was determined using G*Power 3.1 (Faul et al., 2007), indicating that for a medium effect size ($f2= 0.15$, $p < 0.05$) with a power of 0.80 (Chadha et al., 2019), a sample size of 55 participants was required. The study recruited 38 (M_{age} = 23.9, SD = 5.94) undergraduate university students (24 second year and 14 third year) who delivered an assessed presentation as part of their course. Participants disclosed their biological sex and gender (17 females and 21 males), nationality (32 British/English, 1 Dutch, 1 Nigerian, 1 Romanian, 1 South African and 1 Zimbabwean), disability status (34 non disability, 3 living with disability and 1 undisclosed), and family education status (17 were the first in their families to attend university). Cardiovascular reactivity to the assessment was successfully measured in 26 participants, within 90 minutes of their assessment. All participants were offered an entry into a prize draw for their participation.

4.2.3. Measures

Psychometric measures

Participants completed psychometric measures on a tablet in the lab or via an online survey on the Qualtrics software. All psychometric measures have been validated and used in research previously. All participants completed the following surveys.

The following measures utilised in Chapter 3 were also used in this study:

- The Warwick–Edinburgh Mental Wellbeing Scale (WEMWBS; Tennant, et al., 2007)
- The Four Item Social Identity measure (FISI; Doosje, et al., 1995; Postmes et al., 2013)
- Challenge and Threat resources: task importance, self-efficacy, control and achievement goals (Blascovich et al., 2004; Conroy et al., 2003; Jones et al., 2009; Miller et al., 2020; 2021; Perry et al., 2001; Slater et al., 2018)
- The Irrational Performance Beliefs Inventory 2 - iPBi-2 (Turner & Allen, 2018)

The following measures were utilised in addition to the above existing measures that were carried forward from the previous chapter:

The Positive and Negative Affect Scale (PANAS; Watson et al., 1988) – PANAS incorporates two 10-item subscales based on a bidimensional theory of emotion. Positive and Negative affect is a measure of positive and negative affect (Allen et al., 2017). Individuals can experience a mixture of positive affect (e.g., “enthusiastic”) and negative affect (e.g., “afraid”) during a specific period of time. The items are scored on a 5-point Likert scale ranging from 1 (very slightly or not at all) to 5 (extremely). Recent Cronbach’s alphas range from 0.87 for positive affect and 0.84 for negative affect, and 0.90 for positive affect and 0.91 for negative affect (Chadha et al., 2019).

The Perceived Available Support in Sport Questionnaire (PASS-Q; Freeman et al., 2011) – The PASS-Q is a 16 item Likert measure, scored from 1 (Not at all) to 5 (Extremely). It measures four Perceived Social Supports subscales in a motivated performance environment, where individuals deliver a skilled performance in a high-pressure environment,

where succeeding is of great personal importance. The four subscales of the measure represent the four different types of support relevant to a high-pressure environment, i.e., Emotional support, Esteem support, Informational support, and Tangible support. Note that items that specify a sport setting have been adapted to specify an HE setting. A score for each subscale and a global PASS-Q score were calculated by adding up the items and dividing by the number of items.

Self-predicted performance – Measured via a single item asking participants "Based on your best personal prediction, what will be your grade on this assessment?". Participants responded on a 5-point scale: 1: 39% or below (fail); 2: 40-49%; 3: 50-59%; 4: 60-69%; 5: 70%+.

Presentation assessment grades – participants provided their informed consent for their grades on the presentation assessment to be collected from their academic records. The researcher obtained these after the academic board had confirmed them.

Cardiovascular Reactivity (CVR) measures

Participants' CVR to the assessment were measured objectively in the psychology lab by a trained researcher. Each of the consenting participants was connected to a CVR measurement device (Finapres technology, Portapres® Model-2) and was asked to sit as still as possible while watching a 10-minute instructional presentation. The CVR measurement (aligned with similar research, e.g., Miller et al., 2021) is a non-invasive procedure, where a finger cuff is placed on the participant's middle finger and another sensor is attached to a piece of Velcro higher up on their arm (at the level of the heart). The CVR measurement device records beat-to-beat data (e.g. blood pressure, cardiac output, heart rate) throughout the duration of the procedure. To ensure the accuracy of the measurement, the participant is asked to sit as still as possible, and the connected hand is resting on a warm, comfortable pad. The participant was informed throughout the connecting process of what the researcher was doing and why and was asked for consent and feedback at each step (e.g. consent to place the finger cuff on and feedback if they were comfortable). The participant was informed of their right to withdraw from the study at any stage without any

repercussions. Additionally, details of wellbeing support were provided to every participant.

4.2.4. Procedure

The participants were approached during a regularly scheduled academic seminar. If interested, potential participants shared their contact information and booked to come into the lab ahead of presenting for their assessment. All participants completed the psychometric survey pack containing all psychometric measures. The study approached two cohorts of students, one in the second year and one in the third (final) year. All participants came into the lab on the day of their presentation. Within 90 minutes of presenting for their graded assessment, they completed the study psychometrics (Affect, Psychological resources, predicted grade). They were asked to watch a 10-minute presentation while being connected to a cardiovascular response (CVR) measurement device.

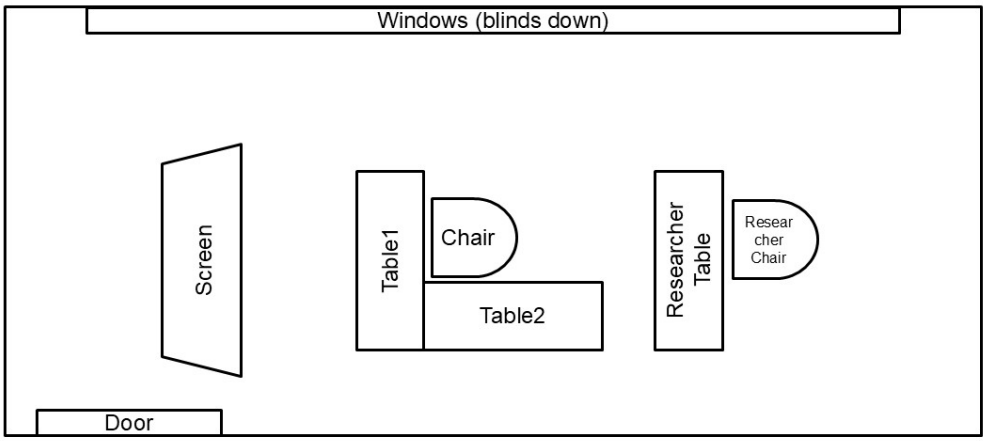
Some participants completed the trait psychometric measures (PASSQ, FISI, and WEMBWES) in the week before presenting to minimise participant burden (N=23). However, not all participants were able to complete the psychometrics ahead of their presentation day; for this reason, some participants (N=15) completed all study procedures on the day of their presentation. This flexibility was considered acceptable to optimise participant numbers and statistical power. The time between trait measures being taken and presenting was recorded and controlled for in the statistical analysis of these variables.

On the day of presenting, participants came into the lab for their state psychometrics and CVR measurement. Participants were asked not to consume caffeine in the hour before their lab session. Each participant entered the psychology lab (see Figure 4.1) and was asked to take a seat behind a table with a screen in front of them and a table on their left (see diagram for lab arrangement). The participant was then asked to rest their left hand on a comfortable, warm pad on the table to their left. The researcher connected the participant to the Portapres (CVR) device, explaining each step, checking whether the participant was comfortable and

asking permission to proceed. The researcher explained that the participant would feel a pulsation in the finger connected to the finger cuff. The researcher explained the lab procedure (participant would need to sit still while they watch, listen to and follow the instructions on screen). Once the participant agreed to proceed and confirmed their understanding of the instructions, and the Portapres device was calibrated (sitting still with the Portapres on for around a minute), the researcher started the video instructions.

The lab instructions – The participant listened to a 4.5-minute guided mindfulness relaxation with instructions to sit back and relax on screen (see Appendix for slides). Following this, the participant was presented with on-screen written instructions and listened to their presentation assessment instructions (see appendix for presentation instructions). They were then asked to “Mentally prepare for your upcoming presentation” for the next couple of minutes. The final slide asked participants to tell the researcher, “How did you prepare for your presentation just now?”. The researcher noted the participant's response and then disconnected them from the Portapres device. Finally, participants were thanked for their time and participation in the study.

Figure 4.1: Lab arrangement



4.2.5. Analytic strategy

Data were examined for outliers and normality, ensuring assumptions for parametric testing were met. Significant outliers with z-scores greater than 3 were identified (Salkind et al., 2010; Smith, 2014). Residualized change

scores (RCS; Turner et al., 2024; Zumbo, 1999) for the cardiovascular data were generated using CO/TPR from the last minute of baseline and the first minute of task engagement. Cardiovascular challenge and threat index scores (CTI) were calculated for each participant by assigning a value of +1 to CO_RCS and -1 for TPR_RCS and summing them up (CO_RCS*1 + TPR_RCS*-1) to generate a single Challenge and Threat Index (CTI) score for each participant in line with TCTSA (Jones et al., 2009). Here, negative CTI scores indicated a Threat response, and positive CTI scores indicated a Challenge response.

Overall analyses were completed in three phases to test H1, H2, H3 and H4:

Phase one: Participant engagement tests and Pearson correlations were carried out to examine the relationship between the primary dependent variables (wellbeing, predicted performance, grades, positive and negative affect), and how these relate to resource appraisals (task self-efficacy, task control, task approach goals and task avoidance goals; where the task is academic performance), social resources (university identity and perceived availability of social support) and irrational performance beliefs.
Participant engagement was tested in three ways. First, participants were asked about the perceived importance of performing well on their assessment. A one-sample t-test was used to compare participants' responses to a value of 1 (not at all important, on the present scale). Second, participants' change in HR between the baseline and assessment instruction phase of the study was tested with a paired samples t-test. Finally, participants' task engagement was tested via a single question at the end of the task, and the researcher recorded their responses.
Phase two: Hypotheses one, two, and three were tested through repeated three-step regression analyses, where either wellbeing, positive affect, negative affect, predicted performance, assessment grades, or cardiovascular challenge/threat reactivity was positioned as the dependent variable. Due to the limited sample size compared to chapter 1 analysis, the regression steps and number of independent variables included were kept to a minimum in this chapter. Furthermore, chapter 1 evidence demonstrates

the ability of the independent variables to predict variability in the dependent variables above and beyond variability predicted by demographics data. Hence, demographic variables were omitted from the regression analysis. The remaining theory-based independent variables were retained for continuity and theoretical alignment.

Six three-step hierarchical regression analyses were conducted to test the explained variability in wellbeing, positive and negative affect, predicted performance, grades and CTI scores. Model/step 1s will test H1, the explained variance owed to the four resource appraisals (task self-efficacy, task control, task approach goals and task avoidance goals; Jones et al., 2009). Model/step 2s will test H2, the explained variance owed to social resources (perceived social support availability and university identity; Meijen et al., 2020). Model/step 3s will test H3, the explained variance owed to irrational performance beliefs (Banks, 2011; Chadha et al., 2019; David & Cramer, 2009; Wood et al., 2017).

Phase three: CTI scores were used to group participants based on their challenge/threat response. Independent samples t-test were conducted to compare challenge and threat responders on each of the study variables. Additionally, all study variables' standardised residual means were graphed for visual representation of participant response groups (challenge responders vs threat responders).

4.3. Results

4.3.1. Phase one: Means, standard deviations, correlations and tests of engagement

Means, standard deviations and correlations for all variables are presented in Table 4.1. Notably, participants' assessment grades only correlated with two other variables: predicted grades (r = .46, p <.05) and biological sex (r = -.47, p <.001). Additionally, participants' cardiovascular responses only correlated with their approach goals (r =.43, p <.05)

A one sample t-test was used to determine the importance rating of performing well on the assessment. The data was skewed in favour of high importance. The mean of 4.31 (SD=0.78) was significantly different to the test value of 1 (not important at all) by 3.31, $t(31) = 24.014$, p <.001, 95% CI [3.03, .3.59]. Participants rated performing on the assessment high in importance.

A paired-samples t-test was used to determine whether there was a statistically significant mean difference between participants' HR during baseline measurement and task measurement. There were no outliers in the data, as assessed by inspection of a boxplot and the standardised residuals. HR scores were normally distributed, as assessed by Shapiro-Wilk's test (p > .55). Participants HR was higher during task instructions, compared to baseline, a mean statistically significant difference of 2.32 (SD = 3.68), 95% CI [0.212, 1.040], $t(26) = 3.277$, p = .003. Participants, cardiovascular response to the task was confirmed to have taken place based on participants increase in HR from baseline.

Lastly, all participants gave an engaged response when asked "how did you prepare for your presentation just now?". Some shared using process-focused techniques, e.g., "I was going through my slide order"; "thinking about what I need to say". Others responded with emotion management techniques or leaned on religion, e.g., "gave myself a peptalk"; "told myself that god will be with me". One participant responded that they "zoned out" during the task.

4.3.2. Phase two: Hierarchical multiple regressions

Six hierarchical multiple regressions were run to determine if resource appraisals (Model 1), social resources (Model 2), and irrational performance beliefs (Model 3) were associated with students' wellbeing, positive and negative affect, predicted performance, assessment grades and cardiovascular challenge and threat responses to the assessment. See Table 4.2 for full details on each regression model.

There was linearity as assessed by partial regression plots and a plot of studentised residuals against the predicted values. There was independence of residuals, as assessed by a Durbin-Watson statistic for each of the regressions, reported in Table 4.2 for each model. There was homoscedasticity, as assessed by visual inspection of a plot of studentised residuals versus unstandardised predicted values. There was no evidence of multicollinearity, as assessed by tolerance values greater than 0.1. There were no studentised deleted residuals greater than ±3 standard deviations, no leverage values greater than 0.2, and values for Cook's distance above 1. The assumption of normality was met, as assessed by the Q-Q Plot.

Wellbeing

Only the first model of resource appraisals was a statistically significant predictor of wellbeing (Model 1), explaining a total of 42.2% of variance, $\Delta R^2 = .499$, $p < .001$, where models 2 and 3 failed to reach statistical significance (see Table 4.2). As seen in study 1 of this thesis, students' self-efficacy was a significant positive predictor of wellbeing, ß = .673, $p < .05$. More specifically, students who reported higher self-efficacy for the assessment also reported significantly higher wellbeing.

Positive affect

The complete model of resource appraisals, social resources, and predisposing beliefs was a statistically significant predictor of positive affect (Model 3), explaining a total of 38% of variance, $\Delta R^2 = .134$, $p < .05$, where models 1 and 2 failed to reach statistical significance (see Table 4.2). Predisposing beliefs (irrational beliefs) were a significant negative predictor of positive affect in students, ß = - .436, $p < .05$. More specifically, students

who reported lower irrational beliefs also reported significantly higher positive affect.

Negative affect

Only the first model of resource appraisals was a statistically significant predictor of negative affect (Model 1), explaining a total of 19.5% of variance, $\Delta R^2 = .302$, $p < .05$, where models 2 and 3 failed to reach statistical significance (see Table 4.2). None of the individual resource appraisal ß values reached statistical significance.

Predicted performance

Only the first model of resource appraisals was a statistically significant predictor of predicted performance (Model 1) explaining a total of 21.5% of variance, $\Delta R^2 = .327$, $p < .05$, where models 2 and 3 failed to reach statistical significance (see Table 4.2). Control was a significant negative predictor of predicted performance, ß = - .352, $p < .05$. More specifically, students who reported higher perceptions of control for the assessment also predicted that their performance would be significantly lower.

Assessment grades

None of the models predicting assessment grades reached statistical significance. Within all three models, self-efficacy emerged as a significant negative predictor of assessment grades, reaching a ß = - .634, $p < .05$ in model 3. Caution should be applied in interpreting the ß value as the overall regression models are not statistically significant.

Challenge and threat index (CTI)

None of the models nor the ß values, predicting CTI scores, reached statistical significance.

*Table 4.1: Number of participants, Means, Standard Deviations, and Correlations of variables. Note: CO, TPR and CTI are unstandardised residualized change scores. Females coded as 1 (N= 16) & males coded as 2 (N=20). * * Statistically significant correlation at = to or <0.001 (2-tailed). * Statistically significant correlation at = to or <0.05 (2-tailed).*

Variable	M	SD	N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Grade	66.74	13.14	34	--															
2. Predicted performance	3.87	0.90	30	**.46***	--														
3. Wellbeing	47.64	6.13	36	-.14	.28	--													
4. CO	0	0.46	29	.13	.09	-.23	--												
5. TPR	0	0.05	29	.15	.22	.04	**-.57****	--											
6. CTI	0	0.71	29	-.02	.24	.04	**.62****	**-.71****	--										
7. Self-efficacy	3.44	0.90	31	-.22	**.48****	**.68****	-.05	.02	.24	--									
8. Control	4.58	0.56	31	-.13	**-.39***	-.05	.21	-.07	-.03	-.09	--								
9. Approach goals	4.87	1.02	31	.18	.03	-.22	**.42***	-.21	**.43***	-.05	-.10	--							
10. Avoidance goals	3.65	1.51	31	-.06	-.33	**-.39***	**.41***	-.31	.21	**-.42***	.04	**.60****	--						
11. Social Support	3.54	0.67	36	-.08	.11	.30	.25	-.15	.15	.26	.22	-.29	-.09	--					
12. University identity	5.20	1.37	36	.16	.23	**.39***	.12	.09	.01	**.50****	.16	.08	-.24	.10	--				
13. Irrational Beliefs	3.10	0.48	36	.10	**-.44***	-.32	.12	.04	-.14	-.33	.12	**.36***	**.45***	-.17	-.16	--			
14. Positive affect	3.08	0.79	32	.17	.34	**.42***	.11	-.08	.33	**.53****	-.12	-.04	-.16	.19	**.48****	-.29	--		
15. Negative affect	1.99	0.69	32	.08	-.04	**-.49****	.28	.03	.04	-.30	.04	**.38***	**.53****	-.17	.01	.32	-.01		
16. Biological sex	--	--	36	**-.47****	-.13	.24	-.22	.02	-.07	.34	-.05	-.24	-.27	.02	.14	.02	-.03	-.16	--
17. Age	23.91	6.07	36	.09	.13	.32	-.05	-.12	.23	.08	.11	-.11	-.08	.07	-.03	-.16	.20	-.13	-.24

*Table 4.2: Hierarchical multiple regressions. * * Statistically significant correlation at = to or <0.01 (2-tailed). * Statistically significant correlation at = to or <0.05 (2-tailed).*

Wellbeing	Model 1					Model 2					Model 3				
Durbin-Watson statistic = 2.072	**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**	
Self-efficacy	**4.740****	**1.122**	**.673**	**2.433**	**7.046**	**4.091***	**1.340**	**.581**	**1.326**	**6.856**	**3.996***	**1.365**	**.567**	**1.173**	**6.819**
Control	-.081	1.582	-.007	-3.333	3.171	-.615	1.714	-.055	-4.153	2.923	-.418	1.763	-.037	-4.065	3.229
Approach Goals	-1.181	1.132	-.191	-3.508	1.145	-1.062	1.273	-.171	-3.690	1.566	-.889	1.317	-.143	-3.614	1.836
Avoidance Goals	.012	.841	.003	-1.717	1.741	-.037	.904	-.009	-1.902	1.828	.052	.926	.012	-1.863	1.967
Social Support						.942	1.463	.105	-2.077	3.962	.904	1.483	.101	-2.163	3.971
University Identity						.529	.793	.115	-1.108	2.166	.435	.816	.095	-1.254	2.124
Irrational Beliefs											-1.542	2.412	-.109	-6.530	3.447
Adjusted R^2 (R^2 change)	.422** (Δ R^2 =.499**)					.396 (Δ R^2 =.018)					.381 (Δ R^2 =.008)				
ANOVA	*F (4,26)* = 6.47**					*F (*6,24) = 4.28*					*F (*7,23) = 3.63*				
Positive Affect	Model 1					Model 2					Model 3				
Durbin-Watson statistic = 2.383	**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**	
Self-efficacy	**.476***	**.156**	**.578**	**.156**	**.796**	.315	.176	.382	-.049	.678	.270	.160	.328	-.060	.601
Control	-.109	.220	-.083	-.561	.342	-.242	.225	-.183	-.707	.224	-.150	.206	-.114	-.577	.277
Approach Goals	-.081	.157	-.111	-.403	.242	-.112	.167	-.154	-.457	.234	-.031	.154	-.043	-.350	.288
Avoidance Goals	.073	.117	.148	-.167	.313	.093	.119	.188	-.152	.338	.135	.108	.273	-.090	.359
Social Support						.102	.192	.098	-.295	.500	.085	.174	.081	-.275	.444
University Identity						.192	.104	.357	-.023	.407	.148	.096	.275	-.050	.346
Irrational Beliefs											**-.720***	**.282**	**-.436**	**-1.305**	**-.136**
Adjusted R^2 (R^2 change)	.187 (Δ R^2 =.295), *p*=.051					.237 (Δ R^2 =.095)					.380* (Δ R^2 =.134*)				
ANOVA	*F (4,26)* = 2.72, *p*=.051					*F (*6,24) = 2.56					*F (*7,23) = 3.62*				
Negative Affect	Model 1					Model 2					Model 3				
Durbin-Watson statistic = 2.314	**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**		**B**	**SE**	**ß**	**95% CI**	
Self-efficacy	-.093	.145	-.121	-.391	.204	-.131	.172	-.171	-.487	.224	-.126	.177	-.164	-.491	.239
Control	.038	.204	.031	-.381	.458	.008	.220	.006	-.447	.462	-.003	.228	-.002	-.475	.469
Approach Goals	.098	.146	.144	-.203	.398	.038	.164	.056	-.300	.375	.028	.170	.042	-.324	.381
Avoidance Goals	.182	.109	.394	-.042	.405	.214	.116	.464	-.026	.454	.209	.120	.454	-.039	.457
Social Support						-.090	.188	-.092	-.478	.298	-.088	.192	-.090	-.485	.309
University Identity						.097	.102	.192	-.114	.307	.102	.106	.202	-.117	.320
Irrational Beliefs											.083	.312	.054	-.562	.729
Adjusted R^2 (R^2 change)	.195* (Δ R^2 =.302*)					.166 (Δ R^2 =.031)					.132 (Δ R^2 =.002)				
ANOVA	*F (4,26)* = 2.81*					*F (*6,24) = 2					*F (*7,23) = 1.65				

Predicted Performance						Model 1					Model 2					Model 3				
Durbin-Watson statistic = 1.895	**B**	**SE**	**ß**	**95%**	**CI**	**B**	**SE**	**ß**	**95%**	**CI**	**B**	**SE**	**ß**	**95%**	**CI**
Self-efficacy	.200	.160	.238	-.130	.531	.145	.189	.172	-.246	.536	.119	.189	.141	-.274	.511
Control	**-.450***	**.217**	**-.352**	**-.898**	**-.002**	**-.501***	**.238**	**-.392**	**-.994**	**-.008**	-.470	.238	-.368	-.964	.024
Approach Goals	.022	.164	.030	-.317	.361	.068	.181	.092	-.308	.444	.118	.185	.159	-.267	.503
Avoidance Goals	-.132	.114	-.280	-.366	.102	-.158	.123	-.334	-.413	.098	-.141	.123	-.299	-.397	.115
Social Support						.162	.202	.161	-.256	.580	.166	.200	.165	-.251	.582
University Identity						.003	.108	.006	-.221	.228	-.021	.109	-.039	-.249	.206
Irrational Beliefs											-.386	.336	-.233	-1.086	.313
Adjusted R^2 (R^2 change)			.215* (Δ R^2 =.327*)					.168 (Δ R^2 =.019)					.180 (Δ R^2 =.039)		
ANOVA			*F (4,24)* = 2.92*					*F (*6,22) = 1.94					*F (*7,21) = 1.88		
Assessment Grades						Model 1					Model 2					Model 3				
Durbin-Watson statistic = 1.895	**B**	**SE**	**ß**	**95%**	**CI**	**B**	**SE**	**ß**	**95%**	**CI**	**B**	**SE**	**ß**	**95%**	**CI**
Self-efficacy	**-5.907***	**2.858**	**-.413**	**-11.781**	**-.033**	**-8.831***	**3.276**	**-.617**	**-15.593**	**-2.070**	**-9.077***	**3.333**	**-.634**	**-15.972**	**-2.181**
Control	-2.421	4.029	-.106	-10.703	5.861	-4.824	4.192	-.211	-13.476	3.829	-4.314	4.307	-.189	-13.223	4.594
Approach Goals	5.664	2.882	.450	-.261	11.589	5.978	3.114	.475	-.448	12.404	6.426	3.218	.510	-.231	13.082
Avoidance Goals	-4.259	2.142	-.497	-8.663	.145	-4.362	2.210	-.509	-8.923	.199	-4.130	2.261	-.482	-8.808	.548
Social Support						3.763	3.578	.207	-3.622	11.147	3.664	3.622	.201	-3.829	11.156
University Identity						2.606	1.940	.279	-1.398	6.610	2.363	1.995	.253	-1.763	6.489
Irrational Beliefs											-3.992	5.891	-.139	-16.179	8.195
Adjusted R^2 (R^2 change)			.092 (Δ R^2 =.213)					.125 (Δ R^2 =.087)					.105 (Δ R^2 =.014)		
ANOVA			*F (4,26)* = 1.76					*F (*6,24) = 1.72					*F (*7,23) = 1.50		
CTI						Model 1					Model 2					Model 3				
Durbin-Watson statistic = 1.605	**B**	**SE**	**ß**	**95%**	**CI**	**B**	**SE**	**ß**	**95%**	**CI**	**B**	**SE**	**ß**	**95%**	**CI**
Self-efficacy	.095	.106	.181	-.124	.315	.027	.122	.051	-.227	.281	.022	.127	.042	-.243	.288
Control	.241	.153	.281	-.075	.558	.184	.160	.214	-.149	.516	.186	.164	.216	-.156	.528
Approach Goals	.134	.106	.281	-.086	.355	.193	.113	.404	-.043	.429	.197	.118	.412	-.048	.442
Avoidance Goals	.111	.079	.346	-.052	.273	.078	.081	.245	-.090	.247	.080	.083	.251	-.094	.254
Social Support						.210	.131	.317	-.062	.483	.210	.134	.317	-.070	.490
University Identity						-.003	.071	-.010	-.151	.144	-.006	.074	-.018	-.160	.148
Irrational Beliefs											-.045	.226	-.040	-.516	.427
Adjusted R^2 (R^2 change)			.189 (Δ R^2 =.309), *p*=.065					.209 (Δ R^2 =.076)					.171 (Δ R^2 =.001)		
ANOVA			*F (4,23)* = 2.57					*F (*6,21) = 2.19					*F (*7,20) = 1.8		

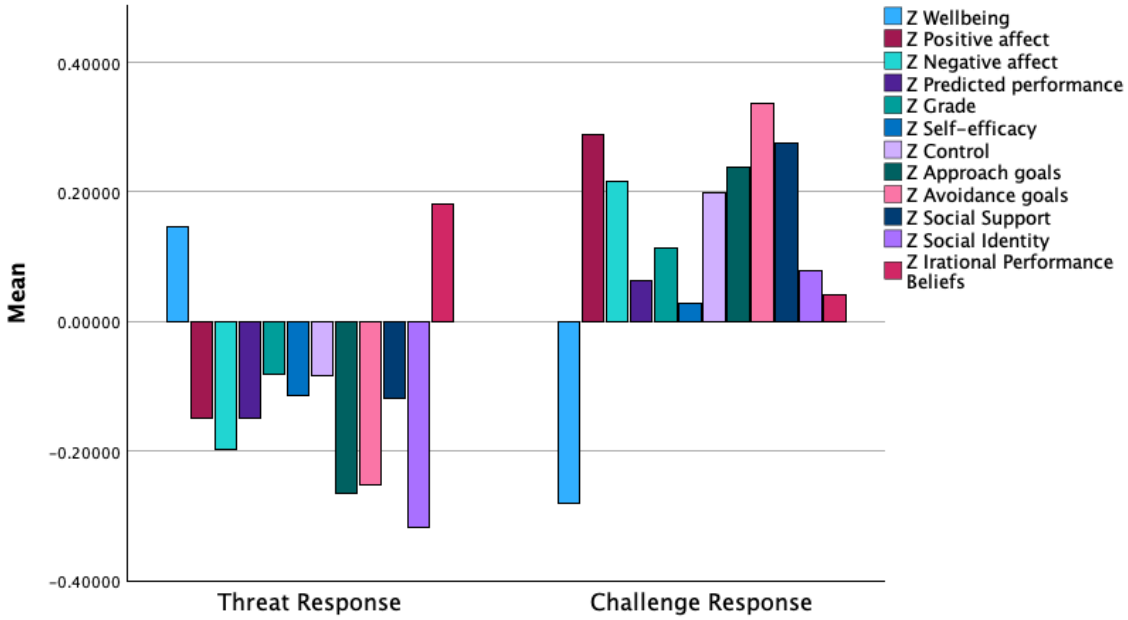
4.3.3. Phase three: exploring differences between challenge and threat responders

Means and standard deviations are available in Table 4.3, and standardised residual means were graphed to visualise group responses (Figure 4.2). Except for wellbeing and avoidance goals, the remaining variable differences are aligned with TCTSA-R (Meijen et al., 2020) direction predictions. However, no statistically significant independent-samples *t*-test emerged from the analysis, indicating no difference between challenge and threat responders across the key variables. This means that threatened participants had lower grades, reported lower resource appraisals, social resources and higher irrational beliefs in comparison to challenged participants; however, these differences were not statistically significant.

Table 4.3: Means and SD for threat and challenge response groups.

	Cardiovascular response	N	Mean	SD
Wellbeing	Threat Response	15	48.53	7.30
	Challenge Response	14	46.29	5.76
Positive Affect	Threat response	15	2.96	0.87
	Challenge response	13	3.31	0.61
Negative Affect	Threat response	15	1.85	0.76
	Challenge response	13	2.14	0.57
Predicted performance	Threat response	14	3.93	0.83
	Challenge response	13	3.92	0.64
Grade	Threat response	15	65.67	15.54
	Challenge response	13	68.23	11.29
Self-efficacy	Threat response	15	3.33	1.21
	Challenge response	13	3.46	0.48
Control	Threat response	15	4.53	0.64
	Challenge response	13	4.69	0.48
Approach Goals	Threat response	15	4.60	1.04
	Challenge response	13	5.12	0.96
Avoidance Goals	Threat response	15	3.27	1.56
	Challenge response	13	4.15	1.39
Social Support	Threat response	15	3.46	0.75
	Challenge response	14	3.74	0.70
Social Identification	Threat response	15	4.77	1.46
	Challenge response	14	5.43	1.34
Irrational Performance Beliefs	Threat response	15	3.19	0.45
	Challenge response	14	3.11	0.44

Figure 4.2: Mean Z scores for all study variables, separated by challenge/threat response.



4.4. Discussion

The purpose of the present study was to address the first and second aims of this thesis by investigating the role of challenge and threat resource appraisals, social resources and irrational performance beliefs on HE students' wellbeing, positive and negative affect, predicted performance, assessment grades and cardiovascular challenge/threat responses to a real-life HE assessment (presentation). This study is one of the few that have applied a biopsychosocial approach to performance and wellbeing within close temporal proximity to a real-life motivated performance (graded assessment).

4.4.1. Summary of findings

Findings H1, H2, and H3 as they apply to student experience (wellbeing, positive and negative affect)

The three related concepts of wellbeing, positive and negative affect, were correlated in the current study; however, each of the variables was related to challenge and threat antecedents differently. More specifically, the results of the current study offer further support for the role of high self-efficacy in greater students' wellbeing and positive affect (H1). Further, irrational beliefs were a further key negative predictor of positive affect (H3). Additionally, the combined model of resource appraisals also significantly predicted negative affect (H1), despite none of the individual ß values reaching statistical significance. A tentative observation of the ß values, however, outlines avoidance goals as the strongest predictor for negative affect. These findings suggest that students tend to report greater wellbeing when they have high task self-efficacy, high positive affect despite low irrational beliefs, and lower negative affect in the presence of low avoidance goals (cautious interpretation).

Findings H1, H2, and H3 as they apply to student performance

Self-predicted performance was significantly correlated with self-efficacy (positive) and control (negative). The influence of resource appraisals (H1) on predicted performance was further evident from the statistically significant

regression model. The β values demonstrate a significant negative influence of control, a non-significant positive relationship of self-efficacy, and a negative influence of avoidance goals. Where self-efficacy and avoidance goals present within the predicted direction (H1), however their ß value confidence intervals straddle 0 and failed to reach statistical significance within the model. In contrast, variability in assessment grades was not explained by any of the suggested models. A cautious observation of the β values reveals a significant negative relationship of self-efficacy and a non-significant negative relationship of control (in opposition to H1). The ß values for approach and avoidance goals follow the predicted direction of H1. Interestingly, the addition of social resources (H2) and cognitive predispositions (H3) led to reductions in R values and F values in opposition to H2 and H3. These findings indicate mixed support for the influence of resource appraisals on performance (Jones et al., 2009. Notably, the study confirms a significant positive correlation between self-predicted performance and grades achieved on the assessment, as well as between biological sex and grades achieved on the assessment (females achieved higher grades compared to males).

Findings H1, H2, and H3 as they apply to students' cardiovascular challenge/threat responses and differences based on response – H4

The current study was successful in inducing and measuring students' cardiovascular challenge/threat response. However, contrary to theoretical predictions (H1), challenge/threat responses were not predicted by resource appraisals (Jones et al., 2009), social resources (H2; Meijen et al., 2020) or irrational beliefs (H3; Chadha et al., 2019). A visual inspection of the mean scores for resource appraisals, social resources, cognitive predispositions, and performance (predicted performance and actual grades) separated by students' cardiovascular challenge/threat response, was aligned with the predicted directions in H4 (except for wellbeing; Figure 4.2). However, none of the between-group differences reached statistical significance. These findings, despite aligning directionally with the theoretical predictions of TCTSA-R (Meijen et al.,2020) are inconclusive and require further exploration.

4.4.2. Interpretation based on literature

The present study findings have partial alignment with existing literature. Firstly, as predicted, students rated their presentation assessment as a task of high personal importance and responded to assessment instructions with a change in cardiovascular activity. These findings position academic assessment as a motivated performance in accordance with TCTSA (Jones et al., 2009). Whilst the data follow the biopsychosocial directional predictions of TCTSA (Jones et al., 2009) and TCTSA-R (Meijen et al., 2020) except for student wellbeing, these differences failed to reach statistical significance in this chapter.

From the perspective of students' resource appraisals (H1), this chapter follows the trajectory of the previous one. More specifically, self-efficacy correlates positively with wellbeing, positive affect, predicted performance and university identity. Self-efficacy plays a partial role in predicting positive and negative affect, and a central role in predicting wellbeing (Chapter 3 of this thesis). However, a cautious review of the current study findings (regressions for predicting grades) reveals a negative influence of self-efficacy on academic performance, contrary to H1 and existing evidence from the literature (Jones et al., 2009). Furthermore, the current study highlighted the resource appraisal: control as a negative predictor of predicted performance, in opposition to H1. Finally, resource appraisals failed to predict students' challenge/threat cardiovascular responses. These mixed results in relation to resource appraisals are not uncommon in challenge and threat research. For example, Meijen and colleagues (2014) found that self-efficacy negatively predicted participants' cardiovascular index of CO and TPR, meaning that higher self-efficacy predicted a threat as opposed to a challenge response.

Next, the predicted integration of social support and social identity into challenge and threat theory (Meijen et al., 2020) was partially supported by the correlations in the context of students' experiences. More specifically, social identification with the university correlated positively with students' wellbeing, positive affect, and self-efficacy. However, contrary to H2, social

identification with the university and social support failed to predict any of the study outcomes. With the exclusion of positive affect, the addition of social resources to regression models led to decreases in the explained variability of the dependent variable. Despite existing evidence from performance (Miller et al., 2021; Slater et al., 2018) and wellbeing research (Green et al., 2021; Kotyśko & Frankowiak, 2025; Mishra, 2020) of social resources did not emerge as significant predictors of student experiences, responses, or performance. Potential reasons for this finding can be either low statistical power, a contextual mismatch between support needed and support measured, or a missing measure for the source of support. More specifically, the perceived availability of emotional, esteem, informational, and tangible support failed to correlate with any other study variables in the present chapter. Alternatively, when considered alongside the results observed in Chapter 3, these findings indicate that the source of support may play a more influential role compared to the type of support (Haslam et al., 2005).

Notably, the operationalisation of social support and social identity within a challenge and threat formulation is an expanding body of research (e.g., Gillman et al., 2023). The social support literature, for example, suggests the key importance of context for the effectiveness of social support, such as support source, type of support, or timing (Gleason & Iida, 2015). In the context of the current study, social support may not be at the forefront of students' appraisals in the context of delivering a presentation by themselves; however, if the context were different (e.g., a group presentation), appraisals of the availability of social support may play a different role.

Separately, the current chapter offers support for the negative influence of irrational performance beliefs on students' positive affect, especially in the absence of high self-efficacy (Chadha et al., 2022; Turner et al., 2024). Interestingly, irrational performance beliefs correlated negatively with performance predictions; however, they failed to predict variability in both predicted and actual performance (H3), contrary to evidence in the literature (Everson & Terjesen, 2023; Meijen et al., 2020; Turner et al., 2024). A potential reason for this could be an indirect influence of irrational beliefs as predispositions to challenge and threat appraisals (Meijen et al., 2020) on HE

performance, as opposed to a direct one. Malkoc and colleagues (2023) found evidence that challenge and threat appraisals have an indirect influence on academic performance via emotions. As such, it follows that predispositions of challenge and threat appraisals are also likely to affect performance indirectly. These are testable predictions for future research. For example, a sufficiently powered study may test for a mediation or moderation influence of predispositions (e.g., irrational beliefs) on outcomes (e.g., academic performance).

Finally, contrary to challenge and threat literature, cardiovascular challenge and threat responses did not correlate with most variables tested in the present study, with the exception of a positive correlation with approach goals. Contrary to theory, the regression analysis in this study did not identify any of the resource appraisals (H1), social resources (H2), or irrational beliefs (H3) as predictors for cardiovascular challenge/threat responses. Moreover, contrary to the consistent performance predictive effect of challenge/threat physiology across the literature (Behnke & Kaczmarek, 2018; Hasse et al., 2019; 2025), the current study failed to detect a statistically significant difference between students who respond with a challenge vs threat physiology (H4). As such, these findings align more closely with Smith and colleagues (2022), who did not observe the theorised predictive ability of resource appraisals on cardiovascular responses in academic performance. Additionally, there was no impact of cardiovascular responses on academic performance despite the close temporal proximity of the measurement (Smith et al., 2022).

Importantly, whilst the present study saw the direction of students' appraisals, beliefs, responses and performance means align with H4 predictions, the lack of statistical significance is an important finding. For example, failure to reach significance may be down to statistical power, choice of measurements, or a lack of theoretical fit. As explained later, future research can replicate this research design with more or larger groups and adapt measures to meet contextual needs. However, even if challenge and threat theory explains the direction of students' experiences and performance in the motivated performance environment of HE, it may be that differences in students' responses (challenge/threat) under pressure do not consistently

lead to a predicted outcome (superior/inferior performance). These inconsistencies of challenge and threat theory's predictive ability have been addressed in the TCTSA-R (Meijen et al., 2020) via a dynamic re-appraisal process, which takes place prior to, during and after a motivated performance. To date, research has adopted a single timepoint measure of challenge and threat responses and appraisals, which is unlikely to be representative of a dynamically changing response. Future research methodology may develop methods of studying challenge and threat as a dynamic process.

The findings of the present study add to the literature by applying TCTSA to an academic context. Collectively, this line of inquiry has led to mixed evidence for the applicability of challenge and threat states in an HE context. For example, some but not all the TCTSA (Jones et al., 200) resource appraisals appear predictive of students' experiences and performance. Furthermore, social resource appraisals' ability to predict challenge and threat responses, performance and wellbeing (Meijen et al., 2020) in an HE context may be more situation-dependent, and further research is needed to explore these questions. As such, the next chapter in this thesis will apply the biopsychosocial framework of the preceding chapters to test the impact of a psycho-social intervention delivered to HE students at the start of the academic year. The specific focus of students' personal and social resource appraisals (Evans et al., 2022) is expected to fit a biopsychosocial context.

4.4.3. Strengths and Limitations

The current study builds on existing evidence in several ways. First and foremost, field-based challenge/threat research has so far been limited to measuring cardiovascular responses to motivated performance, days, weeks and months ahead of the performance in question (e.g., Chadha et al., 2019; Seery et al., 2010; Smith et al., 2022). Alternative lab-based motivated performance on an arbitrary task (e.g., Stroop) studied cardiovascular responses in closer temporal proximity to performance. The current study overcame the two limitations of temporal distance to performance and real-life motivated performance by timing data collection on the day of

performance. As such, the current study extends our understanding of how challenge and threat theory emerges in the motivated performance environment that is academic assessment in HE.

Second, the current study contributes to the developing biopsychosocial theoretical integration of challenge and threat (Jones et al., 2009), social resources and irrational beliefs (Meijen et al., 2020). More specifically, the current study continues to explore the influence of social resources and beliefs on student experiences and performance, testing some of the assertions outlined in TCTSA-R (Meijen et al., 2020). Finally, this study measured the four types of social support (Freeman et al., 2011), which allows for a detailed exploration of the type of support that is suited to the performance context.

The current study is not without limitations. Notably, due to the nature of physiological lab-based methodology alongside the timings of student assessments, the study was limited in its capacity for data collection. Previous challenge and threat research has employed a variety of adaptations to manage these limitations. For example, measuring cardiovascular responses in the days prior to performance (e.g., Chadha et al., 2019) is one way to optimise data collection whilst retaining the benefits of having a cardiovascular measure of challenge and threat. This is one adaptation adopted within the next chapter, where intervention participants' cardiovascular stress response will be measured whilst participants receive the intervention instructions. Other research by Zanstra and colleagues (2010) measured students' cardiovascular response during an academic assessment speech, but similar to the present study, their results tracked in the theorised direction without reaching statistical significance. Alternatively, larger research operations would be required in order to achieve a larger sample size and statistical power when utilising similar biopsychosocial methodology. For example, Chapter 3 of the current thesis achieved greater statistical power by omitting the collection of physiology data.

Separately, a key strength of the previous chapter was the repeated measures, longitudinal design. Despite the experimental design of the present study, it represents only a snapshot of students' experiences and performance from a single assignment. Adding a longitudinal element would

provide a more dynamic picture of students' challenge and threat appraisals and responses. Some studies (e.g., Chadha et al., 2023) have been able to optimise data collection by collecting part of the data (e.g., trait measures) ahead of time, minimising participant and researcher burden. Briefer data collection procedures can prioritise the collection of cardiovascular data in closer temporal proximity to a motivated performance. At the same time, the collection of baseline and follow-up data can provide insight into how variables change over time, in the context of the next chapter, where data collection is separated across multiple phases of the study.

Finally, physiological challenge and threat responses have been found to have a consistent but small effect on performance in recent reviews (Behnke & Kaczmarek, 2018; Hase et al., 2025). In combination with the often small sample sizes utilised in challenge and threat research that involves the measurement of physiological data, the mixed findings of these inquiries are unsurprising. Despite this limitation, meta-analyses and systematic reviews are able to deduce a significant effect of challenge and threat physiology and or bias in the literature. Hence, future research should aim to publish and share findings to add to the collective understanding of challenge and threat responses.

4.4.4. Conclusion

The current chapter and study addressed and expanded the first and second aims of this thesis by investigating the role of challenge and threat resource appraisals, social resources and irrational performance beliefs on HE students' wellbeing, positive and negative affect, predicted performance, assessment grades and cardiovascular challenge/threat responses to a real-life HE assessment (presentation). This study is one of the few that apply a biopsychosocial approach to performance and wellbeing within close temporal proximity to a real-life motivated performance (HE graded assessment). The findings support the positive influence of self-efficacy on student wellbeing and the negative influence of irrational beliefs on positive affect reported by HE students. However, contrary to expectations, social factors and irrational beliefs did not influence performance predictions.

Finally, none of the theorised resource appraisals, social resources or beliefs were able to predict actual assessment grades nor challenge/threat cardiovascular responses.

The next chapter (four) and the final study in this thesis will apply the biopsychosocial perspective from Chapter 3 and the present chapter (three) to examine the impact of a coping-oriented personal disclosure mutual sharing (COPDMS) intervention. More specifically, it will continue to build on the previous chapters by evaluating the biopsychosocial impact of a scalable intervention aimed at improving students' capacity to cope with academic stressors.

Chapter 5. A biopsychosocial examination of a coping-oriented personal disclosure mutual sharing (COPDMS) intervention on student wellbeing in higher education

5.1. Introduction

This final empirical study addresses the first and third aims of this thesis. It addresses the first aim by continuing to test the theoretical integration of social resources (perceived social support availability and social identity) and cognitive predispositions (irrational beliefs) into the TCTSA (a biopsychosocial approach), by testing the influence on cardiovascular indices of challenge and threat responses to a psychosocial intervention. It addresses the third aim of this thesis by evaluating a psychosocial intervention with HE students from a biopsychosocial perspective. Chapter 3 highlighted social support as a direct predictor of student wellbeing. However, Chapter 4 applied a biopsychosocial lens informed by TCTSA-R (Meijen et al., 2020) to HE students' experience (wellbeing and emotion) and academic performance (predicted and actual grades). The findings indicated that social resources may not directly impact students' appraisals, experiences, and performance as individuals. The present study will combine key strengths from the previous two studies to assess the impact of a coping-oriented group sharing intervention, utilising a repeated measures design and a detailed biopsychosocial framework under social circumstances. The following introduction highlights the significance of social factors in coping with stressors within an academic environment.

In line with competitive sport, Higher Education (HE) can be a stressful environment (Pitt et al, 2018), where individual's future careers and wellbeing are often dependent on how well they handle stress and perform under pressure (Shu-Hui & Yun-Chen, 2014). In other words, a context where performance is personally meaningful and an individual is motivated to do

well, facilitates one of two responses based on their appraisal of the situation (demands) and their coping potential (resources; Blascovich et al., 2004; Smith et al., 2022). Where the resources are appraised as sufficient to meet the demands of the performance domain, an individual is likely to approach the performance as a challenge and respond optimally. Where the demands outweigh coping resources, an individual is likely to approach the performance as a threat and respond sub-optimally. Successfully coping with performance domains, like HE, can offer important wellbeing and developmental benefits (Stambulova & Wylleman, 2015).

Existing empirical research offers some understanding of the stressors faced in HE (e.g., transitioning and building relationships; Evans et al., 2022), as well as the potential for personal growth and development that can result from learning to cope with these stressors (Robotham, 2008). Developing the psychological (e.g., confidence) and social (e.g., increased perceived availability of social support) skills to cope with academic stressors effectively can become a blueprint for coping with challenges in sport and further academic development. As such, evidence-based interventions from sporting environments are increasingly being applied in the academic performance domain (e.g., Evans et al., 2022; Smith et al., 2022) and the parallels are becoming clearer. One intervention which is gaining interest in applied sport (e.g., Barker et al., 2014) and academic (Evans et al., 2022) performance research is Personal-Disclosure-Mutual-Sharing (PDMS; Dunn & Holt, 2004), an intervention evidenced to promote social sharing and connection building through personal-disclosure and mutual-sharing of information relating to transitional experiences (Evans et al., 2022).

5.1.1. PDMS in the HE context

PDMS is a communication-oriented intervention that originated from counselling settings and is used to enhance participant self-awareness, empathy, and socioemotional bonds through the public sharing of unknown meaningful stories (Dunn & Holt, 2004; Evans et al., 2013; Evans et al., 2022). PDMS facilitates shared perceptions and mutual understanding through a collaborative process of personal disclosure (Dryden, 2006) and

reflective listening (Yukelson, 2010), in groups. This process can subsequently provide a platform for collective psychological and social constructs (e.g., coping and shared identity) and understandings to emerge (Windsor et al., 2011). These would then become the basis for change in outcome variables such as performance (Barker et al., 2014).

There are currently four types of PDMS based on the targeted content: Relationship-Oriented (ROPDMS; Dunn & Holt, 2004), Mastery-Oriented (MOPDMS; Barker et al., 2014), Rational-Emotive (REPDMS; Vertopoulos & Turner, 2017), and Coping-Oriented (COPDMS; Evans et al., 2018). ROPDMS, the original PDMS intervention, was introduced as a team-building intervention and involves the sharing of information relating to personal character, motivations or desires/goals (Dunn & Holt, 2004). MOPDMS, in turn, targets the antecedents of self-efficacy, successful past performance, verbal persuasion and vicarious experiences (Bandura, 1997), through the sharing and listening to personal accomplishment stories (Barker et al., 2014). REPDMS is a PDMS intervention targeting a change from irrational to rational thinking and would follow initial education on Rational Emotive Behaviour Therapy (REBT; Ellis, 1994). REPDMS has been evidenced to enhance the reduction of irrational beliefs above and beyond reductions based on REBT education alone (Vertopoulos & Turner, 2017). Lastly, COPDMS, involves the sharing of demand and resource cognitive appraisals (Lazarus, 1999) and subsequent coping experiences during stressful transitions, effectively reducing the negative implications of stress (Evans et al., 2018). The current study set out to expand on the work of Evans and colleagues (2018; 2022) in applying PDMS, more specifically COPDMS, to support the transition of sports students into on campus HE.

COPDMS was developed by Evans et al. (2018) and is used to allow participants to share information relating to demand and resource appraisals (Lazarus, 1999) associated with previous and future transitions. Evans and colleagues (2018) used COPDMS to increase athlete self-awareness regarding the demand and resource appraisals (Lazarus, 1999) required to function effectively when faced with career-related challenges such as gaining a professional contract or being released from a team. Most recently, within a higher education institution across two separate 1st year

undergraduate sport student cohorts, COPDMS was found to facilitate an adaptive mentality towards the transition into HE (Evans et al., 2022). Future orientated strategies such as COPDMS appear to provide a novel opportunity for students to make deliberate efforts to reduce or prevent future stressors from occurring and negatively impacting them (Aspinwall & Taylor, 1997; Evans et al., 2018). Specifically, Evans and colleagues (2022) found COPDMS significantly increased perceptions of social support and forms of group identification which are both considered key mechanisms for coping with major life transitions (Halbesleben, 2006; Schlossberg, 1981) that can benefit academic, social, and emotional adjustment to HE (Pratt et al., 2000). Given the promising research findings of COPDMS (Evans et al., 2022) it would seem appropriate to further examine the efficacy of COPDMS among students transitioning into HE as such a social and reflective experience may help to stimulate an approach focus to academic studies which could subsequently benefit student experiences and welfare within, HE settings. Building on the work of Evans and colleagues (2022) and Meijen and colleagues (2020), the current research will be conducting a biopsychosocial examination of the impact of COPDMS on HE students and their wellbeing. The combined social relationship building and cognitive appraisals nature of COPDMS lends itself well to a psycho-social perspective where the resultant increases in social identification with the academic cohort is predicted to result in increased perceptions of available social support (social factors) and personal coping resources (Meijen et al., 2020). Furthermore, the present study will extend the knowledge base in PDMS application by testing the psycho-physiological response to a PDMS intervention. More specifically whether participating in a PDMS intervention is conducive of a motivated performance response (i.e., challenge or threat).

The benefits of the adopted approach are twofold. First, from a theoretical standpoint, the study applies an integrated approach to motivated performance responses, incorporating physiological, psychological and social perspectives. Second, from a practical standpoint, the study will extend existing knowledge around PDMS by evaluating the intervention impact through this integrated perspective. More specifically, the study will evaluate physiological responses to PDMS alongside the psychological and

social change. As a result, the biopsychosocial nature of this research is unique and aims to add to existing research and understanding of the impact and effectiveness of COPDMS for motivated performance contexts.

5.1.2. Stress, appraisals, and the psychophysiological response to motivated performance

Theory

The concept of motivated performance originated in the biopsychosocial model of performance (BPSM; Blascovich & Mendes, 2000; Blascovich & Tomaka, 1996) and was later incorporated into the theory of challenge and threat states in athletes (TCTSA; Jones et al., 2009). Grounded in early stress physiology (Bernard, 1865; Cannon, 1929; Selye, 1936; 1976) and the later transactional model of stress (a.k.a., cognitive appraisals; Lazarus & Folkman, 1984), a motivated performance is one that takes place under circumstances of high personal importance and where the individual is required to exert effort (e.g. academic assessments). The resulting challenge or threat response encompasses a multifaceted set of elements, including cognitive, physical, emotional, and behavioural aspects.

Cognitive appraisals (Lazarus & Folkman, 1984) and the resultant challenge or threat states (Jones et al., 2009) can be used to explain why individuals react differently to similar circumstances. Goal-directed behaviour (e.g., undertaking a transition into HE) and subsequent motivated performance (e.g., in social interactions and academic assessments) are first evaluated through the two-stage cognitive appraisal process (Lazarus & Folkman, 1984). At the first stage, the primary appraisal, the importance and demand of the situation is evaluated as either benign or strenuous. A student is likely to appraise the demands of HE as high effort required, e.g., lecture attendance, group work, reading, writing for assessments. At the second stage, the secondary appraisal, the psychological resources available to meet this demand are evaluated as either sufficient or insufficient. For example, their writing self-efficacy, organisational skills and ability to follow through with study tasks (control). Depending on how the demands and resources measure in comparison to each other the individual is either

threatened (Threat state; where demands outweigh the resources) or challenged (Challenge state; where the resources are sufficient to meet the demands; Jones et al., 2009). Physiologically challenge and threat states are identified by an increase in neuro-endocrine and cardiovascular activity (e.g., increase in adrenalin levels and heart rate). Psychologically challenge and threat responses differ from one another in emotional valence and behavioural responses.

Physiological markers of activation such as neuro-endocrine and cardiovascular activity can be observed in the first seconds of a motivated performance situation becoming salient, resulting in the release of catecholamines, and increase in heart rate (HR; Blascovich, 2008; Dienstbier, 1989). From here a challenge state is characterised by increased HR, stable or decreased total peripheral resistance (TPR) in the blood vessels and increased cardiac output (CO). This increase in CO (i.e. blood flow) allowing for more oxygen and glucose to be circulated to the brain and muscle groups, setting the scene for optimal and/or adaptive responding. By contrast a threat state is characterised by increased HR and TPR, stable or decreased CO, where the lack of blood flow increase deprives the brain and muscles of the necessary oxygen and glucose for optimal responding (Dienstbier, 1989).

Psychologically challenge and threat responses are conceptualised as affective states where they represent the arousal of emotion and the related motivation to take directed action (behaviour), either towards or away from what arouses the emotion. The physiological presentation (HR, CO, and TPR) of emotional arousal in the body is often accompanied by matching self-reports of emotional experiences (Mendes & Park, 2014). Coping from this perspective is a psycho-physiological attempt to meet the demands of, or to reduce the negative consequences of a personally important or stressful situation (Lazarus, 1991). Therefore, a challenge state is where the individual is likely to cope better and experience a higher sense of wellbeing, growth and development (Lazarus, 1991); whereas a threat state is more likely associated with harm or loss (Lazarus & Folkman, 1984).

Research

Psychological appraisals of demands (primary) and resources (secondary) in relation to a motivated performance have been evidenced to influence physiological states. For example, Moore and colleagues (2015) found that reappraisal of physiological arousal in relation to a pressurised task also resulted in enhanced performance. Sammy and colleagues (2017) found that increasing participants resource appraisals through reappraisal, also led to a more favourable (challenge) cardiovascular response during a pressurised task. Additionally, in e-sports Behnke and colleagues (2022) were able to manipulate challenge and threat appraisals through social comparison, where downward comparison produced significant increases in challenge evaluations and upward comparison produced significant threat evaluations. Importantly, an increase of psychological resources was possible through cognitive change, and it subsequently relates to favourable physiological response and performance under pressure.

The TCTSA (Jones et al., 2009) was initially developed to apply to motivated performance under pressure in sporting contexts. However, it has been utilised across a wide spectrum of motivated performance contexts to predict and enhance human functioning in a range of performance domains (e.g., academia, sport, aviation, surgery, business; Moore et al., 2014; Seery et al., 2010; Slater et al., 2016; Vine et al., 2015). Two systematic reviews uncovered a small but stable performance predictive effect of physiological markers of challenge and threat, support the validity of utilising both physiological and appraisal measures, and present themselves across performance contexts (Behnke & Kaczmarek, 2018; Hasse et al., 2019). In academia, Seery and colleagues (2010) found that challenge and threat responses to delivering a talk on one's academic interests were predictive of course scores. Similarly, challenge and threat states in response to a fine motor task (laparoscopic surgery) can be manipulated via task appraisals, subsequently impacting task performance (Moore et al., 2014; Vine et al., 2013). Later, similar results were observed by Vine and colleagues (2015) where a pilots' threat responses led to poorer performance.

Seery and colleagues (2010) were one of few studies to consider academia as a motivated performance domain to which challenge and threat theory

could be applied. They found that challenge and threat responses in relation to delivering a talk on academic interests, explained significant variance in course scores, beyond what was explained by SAT scores and self-efficacy. Interestingly responses to the test taking talks failed to predict course scores and Seery et al. (2010), interpreted their findings to be evidence that academic success may be more reliably predicted by challenge and threat states in the presence of identification and evaluation of personal interests. This could be interpreted as an indication of motivational state and choice autonomy, i.e. a motivated performance.

An integrated biopsychosocial perspective

Later developments in TCTSA (TCTSA-revised; Meijen et al., 2020), integrates social dispositions, more specifically, social support (Shumaker & Brownell, 1984) as a psychosocial resource, thus expanding TCTSA from a psychophysiological model of performing under pressure to a biopsychosocial one. Psychosocial factors such as, social support have been evidenced to facilitate psychophysiological arousal, appraisal and be facilitative to performance and wellbeing (DeFreese & Smith, 2014; Freeman & Rees, 2009; Tamminen et al., 2019). More specifically, evidence demonstrates the facilitative impact of weak social connectedness in eliciting the inferior, threat (as opposed to the superior, challenge), state (Slater et al., 2018).

Social support defined as an interaction between a provider and receiver, involving the exchange of resources to benefit the receiver (Shumaker & Brownell, 1984). Social support can include support structures (a support network), with functional (acts of support) and perceptual (availability) aspects that serve to reduce exposure to stress and enhance coping (Bianco & Eklund, 2001). Additionally, social support as a construct, comprises of four dimensions as they relate to coping. For example, coping with academic transitions may be influenced by social connections and perceptions of available support (Bianco & Eklund, 2001). Social support provisions such as (1) emotional (e.g., feeling cared for and comforted), (2) esteem (e.g., sense of competency and ability is bolstered), (3) informational (e.g., direct advice and guidance), and (4) tangible (e.g., concrete assistance with task

execution), are the 4 types of support evidenced to impact skill performance directly and indirectly (Freeman et al., 2011). Thus, the way that the availability of social support is appraised can establish it as a coping resource.

The mechanisms underlying the relationship between social support and coping, have been the subject of much debate and research. On one side the direct impact of supportive acts (i.e., the main effects model) has been evidenced to impact performance (Arnold et al., 2018; Rees et al., 2007; Rees & Hardy, 2004). On the other, perceptual dimensions of social support (i.e., the stress-buffering effect; Cohen et al., 2000) appear stronger predictors of functional wellbeing (Hartley & Coffee, 2019) and have been positively related to academic achievement (Martínez-López et al., 2023). From this perspective, COPDMS would facilitate the functional development social support networks though mutual sharing, and the added benefit of increased perceived availability of social support as a coping resource.

It would be advantageous for HE transitions to include an element of streamlining social relationships and increasing psychosocial resources through COPDMS. Students transitioning into HE and searching for a sense of belonging and acceptance among fellow students and staff (Smith & Hopkins, 2005) may benefit from an enhanced sense of wellbeing and optimal performance in their studies. In contrast, poor adaptation to HE is associated with lower grades and a lack of social support both of which have been found to be antecedents for increased risk of dropout especially among second and final year students (Sosu & Pheunpha, 2019). A focus on building social connections and belonging during the early stages of transitioning into HE can be beneficial to increasing perceptions of psychological and social coping resources (Meijen et al., 2020).

COPDMS as a source of enhanced biopsychosocial coping

Sharing coping experiences in a group setting, as in the case of a COPDMS intervention can provide a vicarious experience of successful coping, enhancing self-efficacy (Bandura, 1997), while streamlining social connectedness (Evans et al., 2018). For example, McLean and colleagues (2022), found evidence of the stress buffering effect of social support for

students transitioning into HE. In other words, students who perceived higher availability of social support were more effective at coping with academic stress (McLean et al., 2022; Yıldırım et al., 2017).

Furthermore, the coping-oriented (Evans et al., 2022) focus of the present research is grounded in appraisal theory (Lazarus, 1999) and challenge and threat performance environments (Meijen et al., 2020), with the added introduction of cardiovascular stress assessment as it relates to COPDMS participation. As a result, the biopsychosocial nature of this research is unique and aims to add to existing research and understanding of the impact and effectiveness of COPDMS for motivated performance contexts.

5.1.3. The present study

In line with TCTSA-R (Meijen et al., 2020) integration of social resources into challenge and threat theory the present study offers an opportunity to expand our understanding of the psychophysiological responses to COPDMS. To date, evidence has shown that psychophysiological challenge and threat responses present themselves in a motivated performance environments (e.g., academia, sport, aviation, surgery, business; Moore et al., 2014; Seery et al., 2010; Slater et al., 2016; Vine et al., 2015). The present study will seek to extend the definition of motivated performance, to include a social relationship building context, as represented by COPDMS, the benefit of which would be two-fold. Firstly, the integration of social support as a coping resource within an integrated biopsychosocial approach to performance under pressure (Meijen et al., 2020). Second, evidencing the connection between psychophysiological arousal (i.e., challenge/threat response) and social network (in the form of social identity and perceived social support) expansion efforts in HE.

More specifically, the study will test whether a single COPDMS session delivered with students in the beginning of the academic year would foster a greater sense of group identification, raise perceptions of social support availability and boost students' perception of psycho-social resources in the context of their academic studies. The study will employ a repeated measures design to a comparison between an intervention and a control

group. The study's secondary aim is to test whether the COPDMS intervention induces an acute cardiovascular stress response. Thus, exploring participants' psycho-physiological (i.e., challenge or threat) response to intervention participation. Additionally, the study will explore if participants' challenge/threat responses are predictive of their wellbeing and hedonic balance at follow-up.

The following hypotheses will be tested:

Hypotheses (COPDMS vs. Control group):

(1) Compared to the control group, the COPDMS group will report increases in social identity (Dunn & Holt, 2004; Evans et al., 2022) from baseline to post intervention which is then maintained at follow up.

(2) Compared to the control group, the COPDMS group will report increases in social resources (perceived availability of social support, Evans et al., 2018; 2022) and increases in personal (psychological resource appraisals; Lazarus, 1999) from baseline to post-intervention, which is then maintained at follow-up.

(3) Compared to the control group, the COPDMS group will report increased wellbeing (Holt & Dunn, 2006; Pratt et al., 2000; Schlossberg, 1981) and hedonic balance (i.e. affect; Allen et al., 2017) from baseline to follow up.

Hypothesis in participants' response and perceptions of the COPDMS intervention (COPDMS group only):

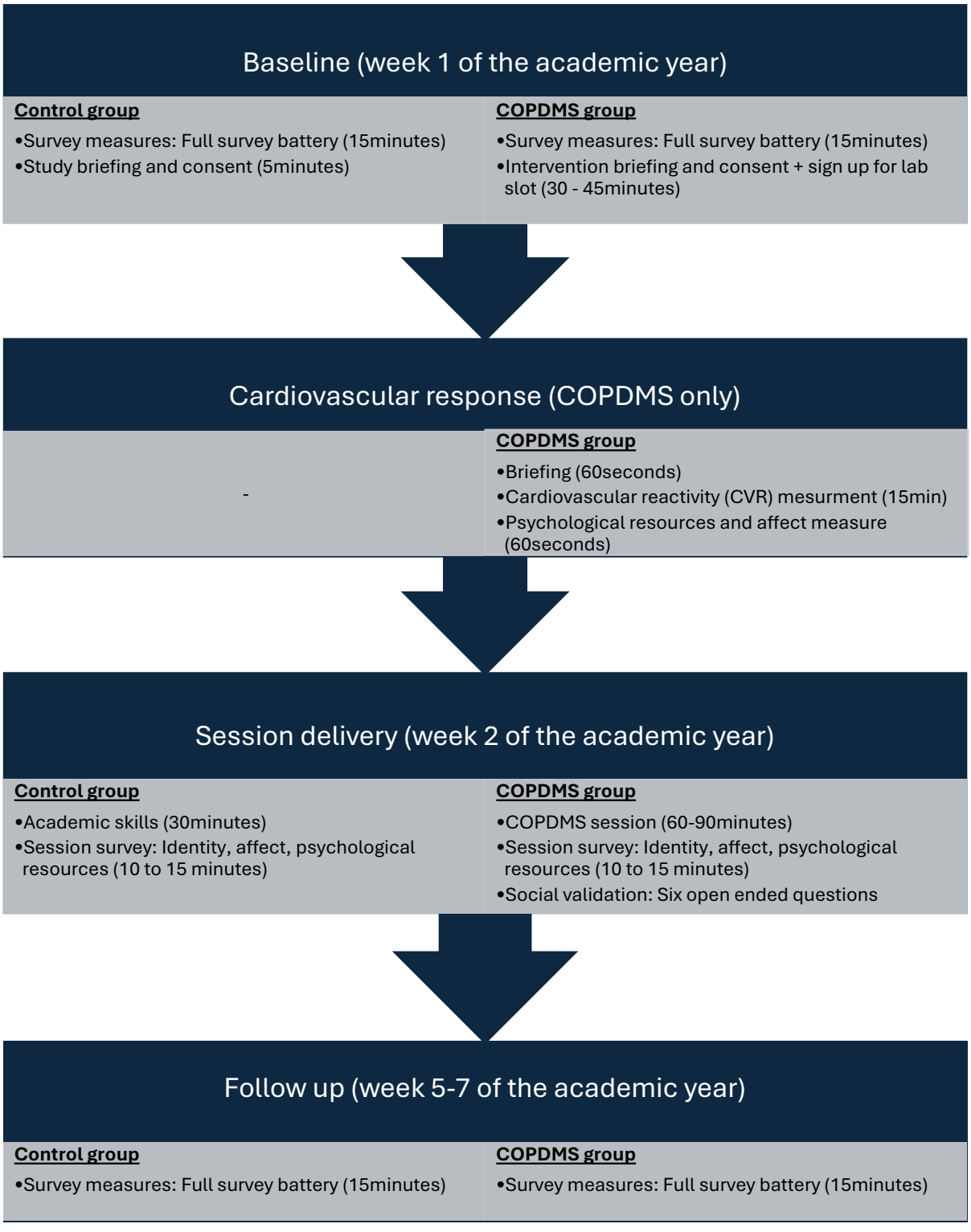
(4) Participants will exhibit a cardiovascular Challenge or Threat response (as measured by the Challenge and Threat Index) to the COPDMS intervention (Evans et al., 2022), and their responses will be predicted by resource appraisals (Jones et al., 2009). Additional exploratory analysis will test whether participants' responses predict wellbeing and affect.

5.2. Methodology

5.2.1. Study design

The study employed a 2 (group) x 3 (timepoint) intervention design with two independent groups of students (control and intervention) completing psychometric measurements at baseline, post-session, and follow-up (Figure 5.1). The control group attended a regularly scheduled academic skills session, while the intervention group completed a single COPDMS session in their course seminar. COPDMS participants attended individual lab sessions where their cardiovascular response was measured and analysed. The between-subjects factor was group (COPDMS vs. control), and the within-subjects factor was time (baseline, post-session, and follow-up). To test hypotheses one, two, and three, a group comparison analytic strategy will be adopted.

Figure 5.9: Temporal model of the study design.



5.2.2. Participants

A total of 112 undergraduate university students started the study. The data from 95 participants (Mage = 20.8, SD = 3.17) were analysed, based on the criteria that the participants had completed the study's baseline phase (68 as part of the intervention group and 27 as part of the control group). A total of 92 participants disclosed their gender (39 female and 52 male), and 91 participants disclosed their disability status (86 no disability and 3 living with a disability). Cardiovascular reactivity to the COPDMS instructions was successfully measured in 16 participants from the COPDMS intervention group. All participants were entered into a prize draw for their participation.

5.2.3. Measures

Psychometric measures

Same as previous chapters

- The Positive and Negative Affect Scale (PANAS; Watson et al., 1988)
- The Warwick–Edinburgh Mental Well-being Scale (WEMWBS; Tennant, et al., 2007)
- The Perceived Available Support in Sport Questionnaire (PASS-Q; Freeman et al., 2011)
- Challenge and Threat resources: task importance, self-efficacy, control and achievement goals (Blascovich et al., 2004; Conroy et al., 2003; Jones et al., 2009; Miller et al., 2020, 2021; Perry et al., 2001; Slater et al., 2018)
- The Positive and Negative Affect Scale (PANAS; Watson et al., 1988)
- The Perceived Available Support in Sport Questionnaire (PASS-Q; Freeman et al., 2011)
- Self-predicted academic performance

The Social Identity Questionnaire for Sport (SIQS; Bruner & Benson, 2018). The SIQS is a nine-item measure designed to reflect how one feels about being a part of their group/team/cohort. The SIQS stem was adapted to specify the students' cohort. It is a measure of Ingroup ties ('I have a lot in common with other members in this group'), Cognitive Centrality ('I often think about the fact that I am a group member') and Ingroup Affect ('I rarely

regret that I am a member of this group') measured on a scale from 1 (strongly disagree) to 7 (strongly agree). Omega coefficient (internal consistency) = 0.84 to 0.89. The SIQS can be scored in three subscales, Ingroup Ties (IT), Cognitive Centrality (CC), and Ingroup Affect (IA), or as a global SIQS score, by adding up the scores and dividing them by the number of items.

Social validation measures

Six social validation questions were formulated based on guidance by Page and Thelwell (2013). The questions addressed the different phases of the intervention, the pre-session preparation of a speech, taking part in the session, and post-session impact. Two questions asked participants about their experience of preparing for the COPDMS session "How did you find preparing for and delivering your speech?" and "How did the lab session make you feel?" (during which participants prepared). Two questions asked about participants' response to the COPDMS session, "How did the public speaking session make you feel?", "How do you think the session will influence you and your university peers?". Two questions were formulated to assess the impact of the COPDMS session: "How has the activity affected the way you view your peers at the university?" and, What have you learnt about yourself and your university peers from the session?".

Cardiovascular Reactivity (CVR) measures

Participants' CVR to the COPDMS intervention were measured objectively in the psychology lab by a trained researcher. Each consenting participant was connected to a CVR measurement device (Portapres® Model-2) and asked to sit as still as possible while watching a 10-minute instructional presentation. The CVR measurement is a non-invasive procedure, where a finger cuff is placed on the participant's middle finger and another sensor is attached to a piece of Velcro higher up on their arm (at the level of the heart). The CVR measurement device records beat-to-beat data (e.g. blood pressure, cardiac output, heart rate) throughout the duration of the procedure. To ensure the accuracy of the measurement, the participant is asked to sit as still as possible, and the connected hand is resting on a

warm, comfortable pad. The participant was informed throughout the connecting process of what the researcher is doing and why and was asked for consent and feedback at each step (e.g. consent to place the finger cuff on and feedback if they are comfortable). The participant was informed of their right to withdraw from the study at any stage without any repercussions. Additionally, details of wellbeing support were provided to every participant.

5.2.4. Procedure

Control and intervention group sampling

The participants were approached during a regularly scheduled academic seminar. There, they completed the baseline psychometric survey pack containing all psychometric measures. The study approached two cohorts of students, where each cohort consisted of two student groups. Student groups were pre-assigned to their group by the academic administration. The study employed a convenience sampling method, selecting one group from each of the cohorts to serve as the control group and the other as the intervention group. Each of the four groups had their own assigned tutor who oversaw the delivery of the academic session where data collection took place.

Control group

At baseline, participants completed a survey pack containing a consent form, demographics form and all psychometric measures during a regularly scheduled seminar in their first week of the academic year. They were instructed that as part of their participation in the study, they would be taking part in an academic skills session the following week in the same seminar. They will be asked to complete a brief survey immediately following the session and a follow-up survey in one month's time. The following week, participants took part in an academic skills session, delivered by their tutor and completed a short survey pack containing SIQS, PASS-Q, Confidence, Control, and AGQ.

Intervention group

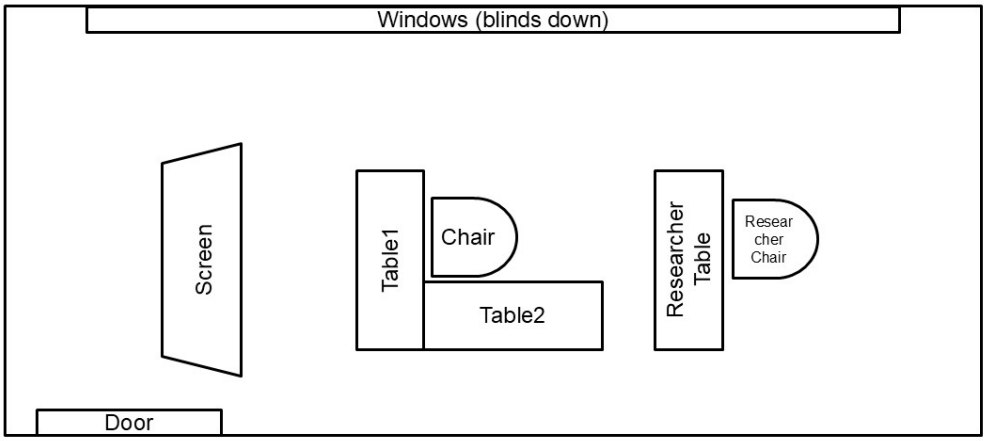
At baseline, participants completed a paper-based survey pack containing a consent form, demographics form and all psychometric measures during a

regularly scheduled seminar in their first week of the academic year. They were instructed that as part of their participation, they would attend a 1-2-1 lab assessment with the lead researcher prior to their next weekly seminar and take part in a sharing session as part of their seminar the following week. Participants booked in their lab slot (described in the next paragraph) with the researcher prior to leaving the seminar. The following week, participants took part in a Coping-Oriented Personal Disclosure Mutual Sharing (COPDMS) session, facilitated by the researcher and their tutor, and completed a short survey pack containing the SIQS, PASS-Q, Confidence, Control, AGQ, and a social validation survey.

Lab session (intervention participants only) – Participants were asked not to consume caffeine in the hour before their lab session. Each participant came into the psychology lab (see Figure 5.2), and they were asked to take a seat behind a table with a screen in front of them and a table on their left (see diagram for lab arrangement). The participant was then asked to rest their left hand on a comfortable, warm pad on the table to their left. The researcher connected the participant to the Portapres (CVR) device, explaining each step, ensuring the participant was comfortable, and obtaining permission to proceed. The researcher explained that the participant would feel a pulsation in the finger connected to the finger cuff. The researcher explained the lab procedure (participants would need to sit still while they watch, listen to and follow the instructions on screen). Once the participant agreed to proceed and confirmed their understanding of the instructions, and the Portapres device was calibrated(by sitting still with the Device on for approximately a minute), the researcher began the video instructions.

The lab instructions – The participant listened to a 4-minute guided mindfulness relaxation with instructions to sit back and relax on screen. Following this, the participant was presented on the screen and listened to the COPDMS session instructions (see appendix for presentation instructions). They were then asked to “Mentally prepare for your upcoming speech” for the next couple of minutes. The final slide asked participants to tell the researcher, “How did you prepare for your speech just now?”. The researcher noted down the participant's response and then disconnected them from the Portapres device. The participant was then asked to complete a brief survey pack containing PANAS, Confidence, Control, and AGQ related to their upcoming speech in the sharing session. Finally, the participant was given a copy of the COPDMS instructions (which they had seen earlier) and asked if they had any questions. Participants were offered

Figure 5.2: Lab arrangement



support with their speech (Warburton et al., 2024); however, no participants took advantage of this offer.

COPDMS intervention procedure

In line with PDMS procedural advice (Warburton et al., 2024), in between baseline and session phases, participants were offered the opportunity to have a 10-minute meeting to review the appropriateness of their COPDMS speech and have their questions answered.

COPDMS procedures followed guidance offered by past research (Holt & Dunn, 2006; Evans et al., 2018; 2022). The intervention started with all participants being welcomed into the session and offered a space to sit. The facilitator set out expectations of the behaviour and nature of communication within the session. Instructions (available in the appendix) were displayed on a screen and on paper to all participants throughout the session. The facilitator then initiated the COPDMS session, and asked participants to share their speeches (5 minutes maximum) one by one, in no particular order. The facilitator rounded of the session and thanked all participants for their involvement. Participants were then asked to complete a brief follow up session validation survey along with brief psychometrics survey.

5.2.5. Analytic strategy

Data preparation and cleaning: Raw data responses were collated into SPSS (version 29) and screened for missing values, 20 (out of 17266; 1.12%) raw data points were means generated based on the variable mean (Kang, 2013). Data were transformed into variables and examined for outliers and normality to ensure that they met the assumptions for parametric testing. Significant outliers (22 out of 4523; 0.49%) with z-scores greater than 3 were winsorized (Salkind et al., 2010; Smith, 2014). In alignment with Chapters 3 and 4, means, standard deviations, and a correlation matrix of the baseline data are presented in Table 5.1.

Group comparison hypotheses (one, two and three) were partially tested due to missing follow-up data (timepoint 3) from the control group. Each hypothesis employed a test-of-differences approach. Two main statistical tests were run per hypothesis to optimise the use of the available data.

Hypothesis (1) Two tests of difference were used to test hypothesis one. First, a repeated measures mixed ANOVA was conducted to compare changes in social identification with their cohort from baseline to post-session (COPDMS intervention vs. academic skills control). Second, a repeated measures ANOVA was conducted to determine whether there was a statistically significant change from baseline to post-intervention and to follow up

(COPDMS group data only), in students' identification with the cohort as a result of the COPDMS intervention.

Hypothesis (2) Two tests of difference were used to test hypothesis two. Initially, a repeated measures mixed MANOVA test was planned to determine if the theoretically linked dependent variables: 'confidence', 'control', 'approach goals', 'avoidance goals', and 'perceptions of social support' (Meijen et al., 2020) would compare changes in psychosocial resources from baseline to post-session. Data from the control group failed to meet linearity assumptions for four out of the five resources. As a result, a simpler comparison was conducted with the perceived social support resources data, utilising a repeated measures mixed ANOVA. Second, a repeated measures MANOVA was used to test if COPDMS participants' psychosocial resources increased from baseline to post-session to follow-up.

Hypothesis (3) First, a paired-samples t-test was used to determine whether there was a statistically significant difference in mean wellbeing between baseline and follow-up within the intervention (COPDMS) group only. Second, a repeated measures MANOVA was used to test if COPDMS participants' hedonic balance (positive and negative affect) increased from baseline to follow-up.

Hypothesis (4) Hypothesis four was tested via a visual inspection of participants' changes in cardiovascular markers of challenge and threat states (HR, CO and TPR) from baseline to the mental speech preparation task. A grouping challenge/threat index (CTI; based on Blascovich et al., 2004) was generated for each participant. Their CO change from baseline to task was weighted positively (+1), and their TPR change from baseline to task was weighted negatively (-1). The resulting index differentiates participants as challenged (positive score) or threatened (negative score). An independent-samples t-test was used to confirm the CTI response difference between challenge and threat responders. Additionally, descriptive statistics of and psychological resources in relation to the COPDMS intervention are presented.

Hypothesis (5) COPDMS participant responses on the six social validation questions were collected immediately after the COPDMS intervention. Responses were collated and analysed based on the principles of content analysis (Berelson, 1952).

5.3. Results

5.3.1. Means, standard deviations, and correlations for baseline data (Table 5.1).

Table 5.1: Cross-sectional baseline data: Number of participants, Means, Standard Deviations, and Correlations of variables. Note: Females coded as 1 (N=36) & males as 2 (N=52).

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Wellbeing	--													
2. Self-efficacy	**.437****	--												
3. Control	**.297****	**.529****	--											
4. Approach goals	.073	**.262***	**.371****	--										
5. Avoidance goals	**-.290****	**-.358****	-.069	**.365****	--									
6. Social Support	.188	**.240***	**.265***	.015	-.145	--								
7. University identity	.179	.205	.177	.157	-.054	**.335****	--							
8. Irrational Beliefs	-.127	.084	.195	**.450****	**.461****	.183	**.303****	--						
9. Positive affect	**.630****	**.600****	**.430****	**.317****	**-.269***	**.271***	**.277****	.084	--					
10. Negative affect	**-.490****	**-.320****	-.142	-.025	**.419****	-.116	-.108	**.261***	**-.415****	--				
11. Age	.187	.143	-.038	-.14	-.138	-.187	-.094	**-.261***	.120	-.189	--			
12. Biological sex	**.228***	.196	.119	.047	**-.294****	-.018	.18	-.157	**.240***	**-.239***	.093	--		
13. Predicted performance	.116	**.249***	.123	.061	**-.259***	.015	.110	.089	.182	-.142	.112	.026	--	
14. CTI (intervention)	-.057	-.128	.010	.305	-.364	-.223	-.215	-.154	.03	-.408	.419	.413	.205	--
Descriptives	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Mean	49.309	3.783	4.644	5.139	4.289	3.593	4.215	3.173	36.648	20.381	20.833	1.590	64.471	0
Std. Deviation	8.107	0.790	0.754	1.041	1.355	0.636	1.095	0.564	6.030	6.158	3.258	0.494	8.075	0.967
N	90	90	90	90	90	89	88	90	90	90	90	88	87	17

* * Statistically significant correlation at = to or <0.001 (2-tailed). * Statistically significant correlation at = to or <0.05 (2-tailed).

5.3.2. Identity change

Between-groups change in identity from baseline to post-session

The dependent variable (SIQS) was normally distributed for each group of the design as assessed by Normal Q-Q Plots. The data was normally distributed across 3 out of 4 cells of the design, as assessed by Shapiro-Wilk's test of normality ($p > .05$). There was homogeneity of variances ($p > .01$) and covariances ($p > .01$), as assessed by Levene's test of homogeneity of variances and Box's M test, respectively. Sphericity is assumed due to the within-subject variable ('time') only having 2 levels. Means and standard deviations for each cell of the design are presented in Table 5.2.

There was no statistically significant interaction between time and condition on participants' SI with the group, $F(1, 57) = 1.22$, $p = .274$, partial $\eta^2 = .021$. There were no statistically significant main effects of time, $F(1,57) = 0.205$, $p = .653$, partial $\eta^2 = .004$ or condition, $F(1,57) = 0.725$, $p = .398$, partial $\eta^2 = .013$, on participants' SI.

Table 5.5: Means and standard deviations of participants' social identification with the group, measured at baseline and immediately post-session (COPDMS intervention VS. control condition).

	Control group (N=12)		COPDMS group (N=47)	
Timepoint	*M*	*SD*	*M*	*SD*
Baseline	4.31	.46	4.26	1.03
Post session	4.41	.77	4.04	.80

Within-group change in identity for COPDMS – Baseline to post-session to follow-up

A one-way repeated measures ANOVA was conducted to determine whether there was a statistically significant change from baseline to post-intervention and follow-up, in students' identification with the cohort as a result of the COPDMS intervention. The data were normally distributed and met sphericity assumptions ($p>.05$). N = 17 COPDMS participants completed all three time-point measurements. Mean cohort identity scores changed from baseline ($M=3.99$, $SD=1.02$), to post-session ($M=4.04$, $SD=0.79$), and at follow-up

(*M*=4.18, *SD*=0.83). However, these changes were not statistically significant, $F(2, 32) = 0.48$, $p = .622$, partial $\eta^2 = .029$.

5.3.3. Psychosocial resources change

Confidence, control, approach goals and avoidance goals data for the control group failed to meet the internal linearity assumption as assessed by Pearson's correlation matrix.

Between-groups change from baseline to post-session

A 2 (Time) x 2 (condition) mixed ANOVA was carried out to examine differences in resource appraisals (perceptions of social support) The data was normally distributed, as assessed by Shapiro-Wilk's test of normality ($p > .05$). There was homogeneity of variances ($p > .05$) and covariances ($p = .146$), as assessed by Levene's test of homogeneity of variances and Box's M test, respectively. Sphericity is assumed due to the within-subject variable ('time') only having 2 levels. Means and standard deviations for each cell of the design are presented in Table 5.3.

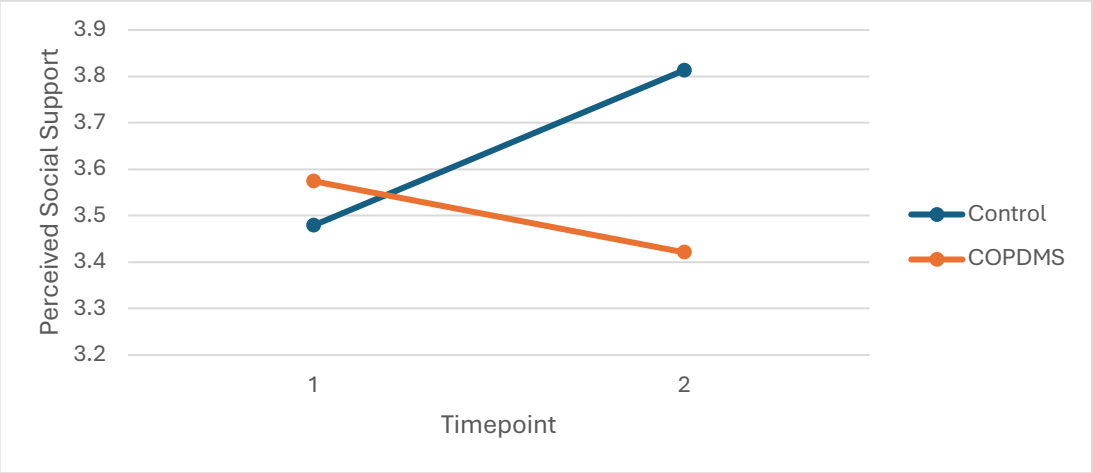
Table 5.6 Means and standard deviations of participants' perceived availability of social support, measured at baseline and immediately post-session (COPDMS intervention VS. control condition).

		Control group (N=12)		COPDMS group (N=47)	
Variable	Timepoint	*M*	*SD*	*M*	*SD*
Perceived Availability of Social Support	Baseline	3.48	.19	3.57	.10
	Post session	3.81	.19	3.42	.10

Main test: There was a statistically significant interaction between the group and time on participants' perceptions of availability of social support, $F(1, 57) = 4.64$, $p = .035$, partial η2 = .075.

The main effect of time on perceptions of social support was not statistically significant, $F(1, 57) = 0.638$, $p = .428$, Wilks' $\Lambda = .989$, partial $\eta^2 = .011$. The main effect of group on perceptions of social support was not statistically significant, $F(1, 57) = 0.666$, $p = .418$, partial $\eta^2 = .012$.

Figure 5.3: Change in Perceived Social Support from baseline to post-intervention/control group activity.



Within-group change for COPDMS – Baseline to post-session to follow-up

A within-subjects MANOVA was used to test whether COPDMS participants' psychosocial resource appraisals (confidence, control, approach goals, avoidance goals, and perceptions of social support) increased from baseline to post-session to follow-up. The data were approximately normally distributed across all data cells, as confirmed by a visual inspection of the Q-Q plots. The data met assumptions for internal linearity, as assessed by Pearson's correlation matrix, and no multicollinearity was detected. Most of the data met the Sphericity assumptions, apart from the data on social support ($p = .005$). The data for Means and Standard deviations are presented in Table 5.4.

There was no statistically significant effect of time on the combined psychosocial resources in the COPDMS group, $F(10, 56) = 0.994$, $p = .460$, Wilks' $\Lambda = .429$, partial $\eta^2 = .148$.

Table 5.4 Means, standard deviations and 95% confidence interval for means of participants' confidence, control, goal orientation and perceived availability of social support, measured at baseline, immediately post-session and at follow-up (COPDMS intervention group only).

Variable	Timepoint	COPDMS group (N=17)		*95% Confidence Interval for Mean*	
		M	*SD*	*Lower Bound*	*Upper Bound*
Confidence	Baseline	3.97	0.60	3.66	4.28
	Post session	4.12	0.70	3.76	4.48
	Follow-up	3.76	0.77	3.37	4.16
Control	Baseline	4.82	0.39	4.62	5.03
	Post session	4.71	0.59	4.40	5.01
	Follow-up	4.59	0.51	4.33	4.85
Approach Goals	Baseline	5.47	1.05	4.93	6.01
	Post session	5.44	1.06	4.90	5.99
	Follow-up	5.38	1.02	4.86	5.91
Avoidance Goals	Baseline	4.38	1.51	3.61	5.16
	Post session	4.06	1.50	3.29	4.83
	Follow-up	4.41	1.39	3.69	5.13
Perceived Availability of Social Support	Baseline	3.57	0.71	3.20	3.93
	Post session	3.46	0.82	3.04	3.88
	Follow-up	3.38	0.79	2.98	3.79

5.3.4. Wellbeing and affect in COPDMS group

Wellbeing

A paired-samples t-test was used to determine whether there was a difference between the reported wellbeing within the intervention (COPDMS) group, at baseline and follow-up. The assumption for normality was not violated as assessed by the Shapiro-Wilk's test ($p > 0.119$). Participants reported wellbeing was higher at baseline ($M = 50.819$, $SD = 1.380$), compared to follow-up ($M = 48.728$, $SD = 1.266$), a statistically significant mean difference of -2.091, 95% CI [0.151,4.030], $t(21) = 2.242$, $p = .036$.

Positive and negative affect

A repeated measures within-subjects MANOVA was used to test if COPDMS participants' affect changed from baseline to follow-up. The data were approximately normally distributed across all data cells, as confirmed by a visual inspection of the Q-Q plots. The data met the assumptions for internal linearity as assessed by Pearson's correlation matrix. No multicollinearity was detected as assessed by Pearson's correlation matrix. The data for Means and Standard deviations are presented in Table 5.5.

Table 5.5: Means, standard deviations and 95% confidence interval for means of participants' confidence, control, goal orientation and perceived availability of social support, measured at baseline, and at follow-up (COPDMS intervention group only).

Variable	Timepoint	COPDMS group (N=22)		*95% Confidence Interval for Mean*	
		M	*SD*	*Lower Bound*	*Upper Bound*
Positive Affect	Baseline	37.91	4.93	35.73	40.09
	Follow-up	33.55	4.63	31.49	35.6
Negative Affect	Baseline	20.29	6.17	17.55	23.02
	Follow-up	22.82	6.12	20.10	25.53

There was a statistically significant effect of time on affect (positive and negative) in the COPDMS group, $F(2, 20) = 7.25$, $p = .004$, Wilks' $\Lambda = .58$, partial $\eta^2 = .894$.

There was a statistically significant decrease of 4.36 in positive affect from baseline to follow-up, $F(1, 21) = 12.584$, $p = .002$, partial $\eta^2 = .922$.

There was an increase of 2,53 in negative affect from baseline to follow-up; however, this was non-significant, $F(1, 21) = 4.267$, $p = .051$, partial $\eta^2 = .504$.

5.3.5. Challenge and threat response to COPDMS

A paired-samples t-test was used to determine whether there was a statistically significant increase in participants' HR from baseline to task, a measure of task engagement (Blascovich et al., 2004). Participants' HR data at baseline and during the task were normally distributed, as assessed by the Shapiro-Wilk test ($p > 0.05$). Participants' HR was higher during the task ($M = 81.852$, $SD = 12.213$), compared to baseline ($M = 80.212$, $SD = 12.372$), a statistically significant difference of 1.639, 95% CI [0.070, 3.209], $t(16) = 2.215$, $p=0.042$.

Visual analysis of the CTI data revealed 10 participants with positive CTI scores (indicating a challenge response) and 7 with negative CTI scores (indicating a threat response). Descriptive statistics, including CTI scores, resource appraisals (confidence, control, approach and avoidance goals) related to the CPDMS intervention, and wellbeing and hedonic balance (positive and negative affect) measured at follow-up for participants based on physiological challenge and threat response grouping, are available in Table 5.6.

Table 5.6: Descriptive statistics for participants based on response.

**Note: CTI scores are standardised residuals of CO and TPR.*

***Participant numbers per group: CTI challenge N=10, threat N=7; Confidence, control, and goals challenge N=10, threat N=6; Wellbeing and affect challenge N=9, threat N=4.*

	Challenge		Threat	
	M	*SD*	*M*	*SD*
CTI	.649	.582	-.927	.534
Confidence	3.4	0.57	3.08	0.86
Control	4.5	0.97	4.67	0.52
Approach goals	5.3	0.95	4.75	1.17
Avoidance goals	4.65	1.18	4.58	1.28
Wellbeing	50.56	6.21	49.25	4.35
Positive affect	35.22	5.07	33	4.69
Negative affect	22.11	6.74	23.75	6.06

The CTI data met assumptions for parametric testing (Q-Q plots inspected and homogeneity of variance at p> .005). An independent samples t-test was run to confirm that the mean difference of 1.57 between participants who responded with a threat response (N=7) and those who responded with a challenge response (N=10) is statistically significant, 95% CI [0.983, 2.167], $t(15) = 5.674$, $p<.001$, Cohen's d = .56.

There were no statistically significant correlations between psychological resource appraisals and CTI scores, nor between CTI scores and wellbeing or affect at follow-up, which prevented further predictive statistical testing.

5.3.6. Social validation

Following the intervention, 50 participants answered the social validation survey. Data from the social validation survey was analysed using inductive content analysis procedures based on procedures outlined by Patton (2002). Three higher-order themes (HOT) were identified from the raw data, with students reporting: (1) positively and negatively valanced emotional experiences, (2) a wide range of experience evaluations, (3) positive changes in their evaluations of the group/others and themselves as a result of the intervention.

The content of the higher order themes was varied, however, four of the reported experiences/evaluations within the lower order themes (LOT) dominated the content of the social validation. These were experiences of: (a) nerves, (b) connectedness, (c) positive changes to self-evaluations, (d) positive changes to other evaluations.

HOT (1) - Emotional experiences: Participants reported emotional experiences in relation to the intervention were both positively and negatively valanced. Some participants reported feeling “comfortable”, “confident”, and “relaxed” about delivering a speech to the group. Others (N=30) reported feeling “nervous”, “anxious” or “uncomfortable” in relation to speaking.

LOT (a) - Nerves, participants identified starting to speak, full speech delivery, speaking in front of a group and in front of new people and sharing personal information (story) as the source of their nerves: “I felt anxious before sharing”, “I was nervous to speak in front of everyone”. Some participants found their nerves more disruptive: “Struggled to control my shaky voice and I found it difficult to share a personal story to the group.”, some reported being less affected: “Slightly nervous but easier as I went on”, and some reported their nerves as a connecting factor for the group: “Everyone seems to be just as nervous as me”.

HOT (2) - Experience evaluations: participants reported a wide variety of evaluations related to their experience of COPDMS. Some evaluated the task of choosing a story to share, speaking in front of a group as the key difficulties of COPDMS. While other participants evaluated the processes of

reflection, learning names and understanding personalities as useful and potentially beneficial for future communication.

LOT (b) - Connectedness: predominantly participants (N=26) reported experiences of closeness with the group immediately after the COPDMS session. Participants identified as feeling more connected: “I feel more related to how they feel and that we have things in common”, understanding: “Makes you more understanding”, respectful: “I now have more understanding of them and respect them all”, and open: “think it’s opened everyone up”, “I got to know new people and sharing my story made it open to everyone”. Some participants reported a positive change in their experience of their peers: “think it [sharing] will make us more comfortable with each other and allow us to communicate easier”, “It’ll help everyone realise that there’s people around if needed and if you need to speak then you can”, “Many of us are very resilient and we all have experiences and skills learnt through these that can be valuable to each-other”. Some felt connected by their concerns: “That others have same concerns as me”, goals: “we are all in it for the same goal”, and interests: “It also allows us to bond better if we have similar interest and struggles or finding if we’re interested in the same sports even.”.

HOT 3 - Evaluation changes the included remaining two LOTs:

LOT (c) - Positive changes to self-evaluations: Participants reported positive self-evaluations related to their COPDMS participation. Some reported re-evaluating their past experiences and nervousness: “Made me realise I shouldn’t be as nervous as I first am”, and viewing themselves as more able, confident and open: “That I can push myself to the limits and prove that I can be the best I can”. Additionally, some reported positively re-evaluating their capacity for growth and self-improvement: “That I’m more confident than usual”, “I am able to reflect positively on past experiences and analyse what I did well and what I could improve upon.”.

LOT (d) - Positive changes to other evaluations: Participants attributed positive other evaluations to their COPDMS participation. Some reported an

increasing interest, sympathy and respect for others (from the group): “I feel as if I know my peers a bit better and makes be happy to continue to get to know them and become friends with my course mates.”. Some participants emphasised the feeling of collective responsibility for their transitional experience: “It will help us create a better environment”, “I feel like everyone now knows each other’s background more and respects each other for that.”, “They all deserve to be treated equally”, and “every person and their experiences are unique, and to show empathy”.

5.4. Discussion

The purpose of the current study was twofold, first, to apply an integrated biopsychosocial examination of a COPDMS intervention with HE students starting on-campus study. Second, to evaluate the impact of COPDMS on HE students' psycho-social coping resources, i.e., self-efficacy, control, approach and avoidance goals, and perceived social support, and to foster social identification. The study hypothesised that participants in the COPDMS intervention (compared to control group participants) will report an increase in social identification with their cohort (H1), an increase in psycho-social resources (H2), and wellbeing and hedonic balance (H3). Separately, the study hypothesised that COPDMS participants would experience an increase in psycho-physiological activation (emotions) in relation to the intervention (Evans et al., 2022; Windsor et al., 2011). With additional exploration of the relationship between psycho-physiological response and wellbeing, positive and negative affect at follow-up (H4).

From the data collected, it was possible to examine psychometric data from both groups (intervention vs control) at two timepoints (baseline and post-session), and at three timepoints (baseline, post-session and follow-up) for the intervention group. The study's findings indicate that a single COPDMS session delivered with HE students in the second week of their first academic year studying on campus was not sufficient in increasing students' social identification with their cohort (H1). Next, the study found no evidence of COPDMS enhancing students' psycho-social resource appraisals (H2), wellbeing, or hedonic balance (H3). More specifically, students who participated in COPDMS reported a significant decline in their wellbeing, with decreased positive emotions and increased negative emotions observed in the first two months of the academic year. Due to low control group participant engagement at follow-up, it was not possible to observe the change in wellbeing and hedonic balance in students who did not take part in a COPDMS session. As such, comparisons between the COPDMS and control group could not be made for wellbeing and hedonic balance. Finally, COPDMS participants responded with challenge and threat physiology in anticipation of taking part in COPDMS, however, this was not related to

psychological resource appraisals (H4). Additionally, challenge and threat physiological responses to COPDMS were not correlated to wellbeing and hedonic balance at follow-up (H4).

5.4.1. Changes in social identity (H1)

An increase in social identity was one of the expected outcomes of COPDMS and the first hypothesis. However, the study failed to identify a statistically significant change in social identification with the cohort. More specifically, there was no difference between the COPDMS and control group participants at post-session, and there was no significant change in the COPDMS group between the three timepoints. In short, COPDMS failed to increase in students' social identification with their cohort. These findings contradict previous COPDMS research in a HE context (Evans et al., 2022), where participants reported increased social identification with their group following the intervention. Potential reasons for the different findings may be due to the use of different measures for social identity, where Evans and colleagues (2022) adopted two relational identification items from Slater and colleagues (2018). The current study utilised a context-adapted (changing wording from "sport team" to "group") version of the SIQS (Bruner & Benson, 2018).

Beyond measurement, several contextual factors may have contributed to the present findings. Firstly, PDMS was developed as a relationship-oriented intervention, i.e., ROPDMS (Dunn & Holt, 2004), and incorporated several active intervention ingredients, such as the setting, speech guidance and facilitation. Where COPDMS deviates from this initial structure is in the instructions, which guide participants to share personal stories about facing adversity and coping, rather than the original social relationship-building instructions. In other words, it is possible that by changing the instructions of PDMS from relationship-oriented to coping-oriented, the remaining active ingredients (such as social sharing) were insufficient in enhancing students' social identification with the group. Second, PDMS research applied to sport will often engage a group of individuals with pre-existing social connections, a shared identity, and a shared performance goal (such as being part of the

same sports team; Barker et al., 2014). Whereas our participants (HE students) would not have pre-existing social connections or a shared group goal. Finally, PDMS research has suggested that multiple PDMS sessions may be more effective in building social connections (Lynch et al., 2023; Pain & Harwood, 2009). These factors may limit the overall effectiveness of the intervention, and future research and applied practice should consider suitable contextual adaptations to enhance the effectiveness of PDMS in facilitating social identification with a group. For example, the timing of PDMS delivery (later in the year) and the number of PDMS sessions delivered (Warburton et al., 2024).

5.4.2. Changes in psycho-social resource appraisals (H2)

An increase in social resources (perceived availability of social support, Evans et al., 2018; 2022) and increases in personal resource appraisals (Lazarus, 1999) were expected outcomes of COPDMS, as per the second hypothesis. More specifically, the COPDMS instruction asked participants to share personal stories of previous transition experiences and the related demands and resources, along with the lessons they could learn from these transitions and apply to their current one.

A significant interaction was found between group (COPDMS and control) and time (baseline to post-session) regarding the perceived availability of social support. However, group means and their graphical presentation were contradictory to those hypothesised. More specifically, the control group increased, and the COPDMS decreased in reported perceived availability of social support. Findings from Evans and colleagues (2022) indicated that perceived availability of social support increased following COPDMS. More specifically, they found evidence for all four categories of social support (emotional, esteem, informational and tangible; Bianco & Eklund, 2001). This is one area of difference, as the present study analysed global scores of perceived social support. Considering the existing support for all four types of social support increases following COPDMS (Evans et al., 2022), the decision to use global scores was made to optimise power for statistical testing.

An influential factor in testing Hypothesis Two was that the personal psychological resource appraisals data in the control group failed to meet the assumptions for linearity across the time points. In contrast, personal psychological resource appraisals data in the COPDMS group did meet assumptions for linearity across the timepoints and were tested. However, there was no statistically significant change in the COPDMS's group in psycho-social resources across the three timepoints (baseline, post-session, follow-up). This is consistent with previous research, which also failed to detect a measurable difference in personal resource appraisals following COPDMS (Evans et al., 2022). A potential reason for this could be that COPDMS instructions target coping and not the specific resource appraisals as outlined in TCTSA (Jones et al., 2009; Meijen et al., 2020). As such the structure of COPDMS instructions could be seen as aligning closer with the BPSM model of challenge and threat (Blascovich, 2008; Blascovich & Mendes, 2000). Future COPDMS research should consider evaluating the impact of the intervention based on perceived coping or align the intervention instructions to specifically target appraisals, self-efficacy, control, approach, and avoidance goals (Jones et al., 2009), as well as perceived social support (Meijen et al., 2020).

The findings should be interpreted in the context of the limited time between timepoints and the opportunity to compare groups. Social support literature has outlined several key considerations when it comes to the effectiveness of social support (Gillman et al., 2023; Haslam et al., 2005; Zee & Bolger, 2019). Applicable to the present study context is that perceived social support is often enhanced by a shared social identity and the match between the type of social support needed at that point in time and the type made salient through the intervention (Haslam et al.,2005; Zee & Bolger, 2019). Additionally, the theory of optimal matching (Cutrona, 1990; Cutrona & Russell, 1990) suggests that social support provided in response to present needs may be more effective in making the availability of social support salient. For example, students at the beginning of the academic year may benefit most from informational and tangible support in preparing for the challenges of HE. Future research should consider the type of social support most relevant to the context and the appropriate timing for measurement

(received or perceived social support), i.e., do we need to allow more time to pass to present opportunities for utilising the social support available, thus providing experiential evidence for the availability of social support.

5.4.3. Changes in wellbeing and hedonic balance (H3)

The study's applied aims were to enhance the wellbeing of HE students (Evans et al., 2022; Pratt et al., 2000; Schlossberg, 1981) and their hedonic balance (Allen et al., 2017) through a COPDMS intervention integrated into regular course seminar delivery. The study found evidence that COPDMS participants' wellbeing and positive affect reduced, while negative affect increased in the first two months of the academic year. These findings are contrary to H3 predictions; however, they must be interpreted within the contextual constraints of the project. Due to low control group participant engagement at follow up, the study was not able to observe the change in wellbeing and hedonic balance in students who did not take part in a COPDMS session. The study failed to make a comparison in reported wellbeing and hedonic balance changes between COPDMS and control group participants. Under these circumstances it is not possible to draw conclusions on the impact of COPDMS on participants' wellbeing and hedonic balance.

Furthermore, the decrease in wellbeing and positive affect and increase in negative affect for COPDMS participants must be considered in the broader temporal context of the academic year. The beginning of the academic year may be considered an exciting time of new beginnings, whereas two months in students are more likely to have increase clarity of the challenges of academic studies. It is for this reason that the present study cannot make a conclusive interpretation of the findings on the impact of COPDMS on student wellbeing and hedonic balance, without the comparison to the control group.

5.4.4. A biopsychosocial examination of PDMS (H4)

The study aimed to apply a holistic biopsychosocial (TCTSA-R; Meijen et al. 2020) evaluation to the impact of the COPDMS intervention. COPDMS

participants responded with challenge and threat physiology (Blascovich et al., 2004; Jones et al., 2009) in anticipation of taking part in the intervention. However, this physiological response did not relate to psychological resource appraisals (self-efficacy, control, and goals) nor to their wellbeing and hedonic balance.

Recently TCTSA has transitioned from a theoretical model of challenge and threat sitting on the opposite ends of a single continuum (Jones et al., 2009), to them sitting on separate continuums (Meijen et al., 2020; Uphill et al., 2019). The present study has utilised a single challenge and threat continuum by indexing CO and TPR as an effective way of reducing the number of variables for the purpose of increasing statistical power (Seery et al., 2010). This established method of analysing the cardiovascular markers of challenge and threat must however be considered with caution, as historically they have produced mixed evidence (Meijen et al., 2020)

Separately, the social validation of COPDMS in the present study offers another layer to understanding participants experiences. As presented in the results and in the appendix, participants reported a mixture of positive and negative emotional responses to the intervention. Whilst some reported reservations to engaging in the sharing activity, the majority found it transformative to how they view their peers and how connected they feel to them. These findings not unlike Evans and colleagues (2022) second study, highlights the emotional engagement of participants. However, the present study takes the evidence a step further in presenting evidence of the physiological activation.

Finally, existing research suggests that a challenge response is more likely to be conducive to wellbeing (Brown et al., 2021; McLoughlin et al., 2024; Yeager et al., 2022); however, the present study did not observe evidence to support this claim. Like the hypotheses above, caution must be applied when interpreting the findings. Whilst the selected measure, the WEMWBS (Tennant, et al., 2007) is a globally used scale for measuring wellbeing, other research has found other related concepts/measures to be good indicators of wellbeing. For example, vitality (McLoughlin et al., 2024) and thriving (Brown et al., 2021) under pressure have been found to relate to challenge responding and enhanced performance. Notably, a clearer link between

challenge/threat responding and wellbeing has been suggested at the trait (as opposed to state) measurement level (Mansel, 2021; Mansel et al., 2023). It would be advantageous for future experimental research to employ trait measures of challenge and threat mindset.

5.4.5. Limitations and considerations

Additional field-based limitations and variability beyond the protocol's control must be considered in the present study. For example, as intervention and control participants were of the same course, they are likely to interact with one another, influencing the group's results. Second, sampling into the groups was determined by a participant's presence in the COPDMS session. Some participants initially completed their baseline as part of the control group and then joined the seminar group where the intervention took place. As such, they were treated as intervention participants, resulting in unequal variances between the groups. Future research should consider ways to design PDMS-controlled trials where between-group contamination is minimised. For example, in order to retain some of the contextual similarities between groups, cohorts from different academic years can be sampled. Alternatively, entire course groups can be randomly allocated to a control or intervention group, as opposed to a single course group being split into two. Separately, these findings must be considered within the temporal limitations of demand and resource appraisals in a motivated performance context. Demand and resource appraisals and subsequent reappraisals represent a dynamic process of continuously changing appraisals within the same context (Meijen et al., 2020). Temporally demands and resources can become salient through contextual cues, feedback, and instructions (Moore et al., 2012; Sammy et al., 2017; Turner et al., 2012, 2014), presenting an ever-shifting dynamic of challenge and threat responding. For example, perceived resources in the beginning of the academic year (baseline) may have been sufficient to meet the perceived HE demands at that point in time. As the academic year progressed (2months later at follow-up), the perceived demands of HE increased or became more salient and as such, resources may have been evaluated as less sufficient. This dynamically developing

appraisal process is one likely explanation for the results observed in the present study. Future studies should consider the temporal developments of the performance environment and time follow-up measurements accordingly. Alternatively, qualitative follow-up methods (e.g., focus groups or interviews; Barker et al., 2014; Evans et al., 2022) may provide a richer contextual understanding of changing appraisals.

Other potential limitations could be the use of a single-item measurement methodology for the theoretically related concepts of self-efficacy, control, approach, and avoidance goals (Jones et al., 2009). Even though challenge and threat theory and research have made substantial progress towards a holistic biopsychosocial perspective of human performance and wellbeing, there are still related measurement limitations when it comes to measuring demand and resource appraisals as part of a holistic theory (Meijen et al., 2020). Instead, these appraisals are often measured via single-item measures, which are not without their limitations in reflecting the complexity of these psychological concepts. Future research should consider developing sound measures of demand and resource appraisals in line with contemporary theory (i.e., TCTSA-R; Meijen et al., 2020).

Finally, a key limitation in testing the study hypotheses was presented by the lack of participant engagement from the control group at follow-up. Upon reflection, there are several procedural and methodological resolutions. Baseline data was collected via paper surveys, during regularly scheduled seminars, whereas follow-up data was collected via an online survey sent to participants' student email. The former process provided dedicated time for participants to complete the measures, where the latter required participants to find the time themselves. Nevertheless, it is important to consider that 22 out of 64 (34%) participants from the COPDMS group completed the follow up, compared to 4 out of 26 (15%) participants from the control group. This indicates that COPDMS participants were more engaged in the research than control group participants. One suggestion that may be applicable in the HE context would be to optimise participant re-engagement at follow-up through dedicating seminar time to data collection.

5.4.6. Conclusion

The study's aims were both theoretical and applied, addressing the first (theoretical integration of social resources and cognitive predispositions into the TCTSA) and third (evaluating a psychosocial intervention with HE students from a biopsychosocial perspective) aims of this thesis. First, the study aimed to apply a holistic biopsychosocial evaluation based on TCTSA/TCTSA-R (Jones et al., 2009; Meijen et al., 2020) to the impact of the intervention. The present study confirmed that PDMS participants respond with challenge and threat physiology in anticipation of participating in PDMS; however, psychological resource appraisals related to PDMS were not correlated with participants' physiological responses.

Next, the applied aims were to enhance the wellbeing and hedonic balance of HE students through a COPDMS intervention integrated into regular course seminar delivery. The study did not find evidence of increased psychosocial resources or social identity resulting from COPDMS. Moreover, the study found evidence that the wellbeing and positive affect of COPDMS participants reduced, while their negative affect increased in the first two months of the academic year. Similar to existing COPDMS research, the participants in the present study reported several expected qualitative changes (e.g., increased connectedness with their peers), but failed to detect any quantitative changes (i.e., changes in psychometric scores).

Chapter 6. General Discussion

6.1. Summary of findings

This thesis set out to advance understanding of student wellbeing and academic performance in higher education (HE) by empirically evaluating a biopsychosocial model of challenge and threat responses, including social and cognitive antecedents (TCTSA-R; Meijen et al., 2020). This body of research consists of three complementary studies: 1) A year-long longitudinal analysis; 2) A field-based biopsychosocial study of HE assessment stress; and 3) A biopsychosocial evaluation of a coping-oriented personal disclosure mutual sharing intervention (COPDMS; Evans et al., 2019; 2022). The three empirical studies explored how personal (i.e., resource appraisals; Jones et al., 2009), social (i.e., social support availability and social identity; Meijen et al., 2020), and cognitive antecedents (i.e., irrational performance beliefs; Chadha et al., 2019; 2023; Turner et al., 2024) shape student affect, wellbeing, and performance throughout the academic year and in high-pressure assessments, as well as in response to a novel coping-oriented social intervention.

The specific aims of this thesis were to: 1) Test the theoretical integration of social resources (perceived social support availability and social identity) and cognitive predispositions (irrational beliefs) into the TCTSA (a biopsychosocial approach), by examining the influence on student wellbeing and performance (chapters two and three) and cardiovascular indices of challenge and threat (i.e., CO and TPR; chapters three and four); 2) Test the applicability of a biopsychosocial approach to performance and wellbeing in HE students (chapters two and three); 3) Evaluate a COPDMS intervention from a biopsychosocial perspective (Chapter 5).

In Chapter 3, the longitudinal effects of challenge/threat resource appraisals, social resources (i.e., support and identity) and irrational performance beliefs, on wellbeing and performance were examined. The focus was within the motivated performance context of HE, namely, student wellbeing and predicted academic performance across one full academic year. The results indicated that self-efficacy plays a key role in both student wellbeing and

predicted academic performance. Additionally, whilst perceived high social support availability alongside low prevalence of irrational beliefs are conducive to greater student wellbeing, these may not be directly influential towards better academic performance predictions. Finally, contrary to expectations, students identified less with their university as the academic year progressed, and their university social identity was a negative predictor of predicted academic performance.

In Chapter 4, the effects of challenge/threat states and resource appraisals, social resources (support and identity), irrational performance beliefs, wellbeing and performance were examined. The focus was within the motivated performance context of assessment performance in HE, namely student experiences (wellbeing and affect) and academic performance (predicted and achieved grades). This study is one of the few that apply a biopsychosocial approach to real-life presentation assessment, where students' performance (grades) form part of their final HE award/degree. Similarly to Chapter 3, the findings support the positive influence of self-efficacy on wellbeing and failed to support the role of social resources and irrational performance beliefs in predicting performance. Additionally, positive affect was negatively influenced by irrational performance beliefs. Finally, results indicated that none of the theorised resource appraisals, social resources or beliefs were able to predict challenge/threat cardiovascular responses nor actual assessment grades.

Chapter 5 brings together key strengths from chapters two and three to study the biopsychosocial impact of a COPDMS intervention delivered with HE students transitioning into on-campus study. A repeated measures design (pre- and post-intervention, and follow-up) was employed, making this the first study to test cardiovascular responses, affect, and resource appraisals related to a PDMS intervention. Results indicated that students did have a cardiovascular response to the COPDMS intervention instructions (indicating engagement with the intervention). Separately, the COPDMS intervention did not result in significant increases in wellbeing, positive affect (and decrease in negative affect), nor social identification with the cohort. A significant change in perceptions of social support availability occurred as an interaction between group participation (intervention vs. control) and time (pre- to post-

session); however, this was in opposition to the hypothesised interaction. More specifically, perceptions of social support availability increased for control group participants, while decreasing for participants in the COPDMS intervention. Like existing COPDMS research, participants reported qualitative changes in how they relate to their cohort, but these changes were not reflected in the psychometric measures. Next, the implications of the above findings are discussed in the context of theory, research and applied practice.

6.2. Significance and Implications of Findings

6.2.1. Theoretical Implications

Theorising about challenge and threat responses to a motivated performance has led to leaps in our understanding of human performance in the presence of stress (Hase et al., 2025). More specifically, a challenge, in comparison to a threat, response is more often associated with superior performance. Challenge and threat states have shown to be predictive of performance across domains, including aircraft piloting (Vine et al, 2015), doctors' assessments (Roberts et al., 2015), sports (Evans et al., 2019), e-sports (Behnke et al., 2022), education (Jamieson et al., 2016; 2021; 2022), and the evidence is continuously and systematically reviewed (Behnke & Kaczmarek, 2018; Hase et al., 2019; 2025). Nevertheless, the precise mechanisms (appraisals, predispositions) driving this predictive ability have been less researched under a biopsychosocial formulation of challenge and threat, such as the one suggested by TCTSA-R (Meijen et al., 2020). For example, the following sections will review the findings of this thesis within the context of cardiovascular reactivity (CVR) challenge/threat responses, resource appraisals, social support and social identity, and irrational performance beliefs as part of a biopsychosocial model of HE students' wellbeing and performance. Starting with the CVR indices of challenge and threat (i.e., CO and TPR), which have been analysed differently across the literature. While some studies have found that CO and TPR to predict academic performance

(e.g., Seery et al., 2010), others have not found such evidence (e.g., Chapter 4 in the current thesis; Smith et al., 2022).

The role of cardiovascular challenge/threat responses in a biopsychosocial model of HE students' wellbeing and performance

A recently updated meta-analysis of the effect of challenge and threat responses on performance (Hase et al., 2025) has identified only one empirical study into academic performance that included testing students' cardiovascular response (i.e., CO and TPR). As discussed in chapter one, Smith and colleagues (2022) tested HE students' CO/TPR response to academic speech delivery task instructions and found mixed evidence for the predictive ability of CO/TPR for academic performance. Together with the findings presented in Chapter 4, cardiovascular indices of challenge and threat (i.e., CO/TPR) were uncorrelated with both academic performance and wellbeing. Furthermore, students' resource appraisals (as suggested by TCTSA; Jones et al., 2009), as well as social and cognitive predispositions (as indicated by TCTSA-R; Meijen et al., 2020), failed to correlate or predict CO/TPR responses when measured on the day of performing (Chapter 4). Historically, CO/TPR research has been challenging to conduct due to the related methodological limitations. Firstly, beat-to-beat cardiovascular measurement technology is expensive and not widely available outside of research/academic institutions. Second, measurement procedures mean that there is a strict limitation on participant mobility. More specifically, for the CO/TPR change to be isolated as occurring as a result of psychological processes (e.g., appraisals), the participant must sit still and not talk for the duration of the measurement. As a result, research procedures are often carried out under lab conditions and utilise visual and auditory instructions (e.g., "mentally prepare for your speech") whilst the participant sits still. Two key limitations often apply to CVR response research. First, the temporal distance from the motivated performance event is increased to have time for data collection. To manage this, cardiovascular challenge/threat responses have been measured more often days or weeks ahead of motivated performance (real-life performance, competition, event; e.g., Chadha et al., 2019). Measuring responses in this way implies that the

performer is responding to the stressor (i.e., the motivated performance situation) in the absence of the said stressor. Second, an artificial, lab-based stressor (e.g., math, Stroop, speech, throwing task, etc.) is utilised to overcome the first limitation and study the stress response immediately before the stressor situation. However, measuring responses in this way implies that responding to a real-life stressor (such as performance, competition, or an event) is the same as or equivalent to responding to an artificial stressor.

To overcome these limitations, in limited cases, participants have undergone cardiovascular measurements during a real-life, motivated performance (e.g., Zanstra et al., 2010), provided that this does not involve metabolic exertion, which can interfere with measurement (Blascovich et al., 2004). One aim in Chapter 4 was to work with the above limitations and measure CVR responses in close temporal proximity (within 15 to 90 minutes) to a naturally occurring (as opposed to lab-based) motivated performance, namely a presentation on a graded assessment that was already part of students' course. Here, the aim was to test participants' responses as close as possible to the time of performing, and the 15-90minutes range was the result of practical adaptations such as time needed to complete the study, presentation schedule, and participant availability. In doing so, the study in Chapter 4 demonstrated an alternative procedure/methodology to those utilised at present and tests its validity in an HE performance context. As a result, this measurement methodology was made available to test participants' CVR responses to a COPDMS intervention in Chapter 5.

Additional challenges related to studying CVR responses in relation to motivated performance are addressed in the analysis of CO and TPR measures. Originally, challenge/threat theorising suggested indexing the two measures into a single scale – a challenge and threat index (CTI; Blascovich et al., 2004), whereas more recent theory suggests that challenge and threat should be considered as independent scales (Meijen et al., 2020; Uphill et al., 2019). Research has found both the CTI and a CO/TPR split analysis to be predictive of performance (e.g., Seery et al., 2010; Turner et al., 2014). However, these physiological measures of challenge/threat responding in relation to a

motivated performance have historically been interpreted to have small effect sizes (Hase et al., 2025). CTI was measured in the present thesis and similar research (Smith et al., 2022) within a small sample and was found not to be predictive of performance or wellbeing. Possible explanations include the above-suggested small effect, meaning that a larger sample size is needed to test the role of CTI in students' wellbeing and performance.

Alternatively, CTI may be a poor predictor within the HE context, due to the prolonged exposure and performance demands of the context. For example, an increase in CO and a decrease in TPR (i.e., a challenge response) can be effective for delivering energy to the brain and muscles for a brief moment of skill execution in competition, such as taking a golf shot (Chadha et al., 2019). However, it is possible that writing or presenting (e.g., Chapter 4) for assessment or taking an exam in the absence of a competitive motivator may present differently on a physiological level. Meijen and colleagues (2020) identified two neuropeptides (oxytocin and neuropeptide Y) that may play a role in challenge and threat responses in the presence of a stressor. Bearing in mind that students are likely to spend three or more years in HE, they may be subject to a prolonged exposure to academic stress, where the demands of living independently (often for the first time), building new personal and professional relationships, all alongside study and assessments. Future research should consider alternative physiological response indicators that better fit the prolonged exposure to stressors of the HE context. Importantly, challenge/threat physiology within any motivated performance context is likely to be influenced by cognitive appraisals (resource appraisals; Jones et al., 2009; Meijen et al., 2020).

The role of resource appraisals in a biopsychosocial model of HE students' wellbeing and performance

Across the three studies of the current thesis, several consistent patterns and theoretical challenges emerged. First, self-efficacy (Bandura, 1997) was the most robust resource appraisal predictor of student wellbeing and affect as well as positive performance expectations, in both the longitudinal study

(Chapter 3) and acute stress studies (chapters three and four). Students reporting higher self-efficacy also tended to predict better academic outcomes for themselves, aligning directly with challenge/threat and appraisal theories (Jones et al., 2009; Lazarus & Folkman, 1984; Meijen et al., 2020).

Second, despite the theorised links (Jones et al., 2009), the remaining resource appraisals, such as achievement goals, produced mixed or unstable effects on performance. While appraisals of control and avoidance goals displayed inconsistent relationships with wellbeing and performance, highlighting the complexity of these constructs in the HE context.

Interestingly, Chapter 3 revealed that three out of four resource appraisals suggested by Jones and colleagues (2009) in the formulation of TCTSA remained unchanged over time (Chapter 3). For example, previous research into motivated performance in academia has highlighted that academic self-efficacy reliably increases as a function of time spent in academia (Kordsalarzehi et al., 2025). One intervention study examining the motivation and self-efficacy of nursing students found that both the intervention and control group participants' self-efficacy improved over time, despite a significant reduction in motivation in the control group participants (Kordsalarzehi et al., 2025).

Additionally, the significant reduction in students' approach goals observed in Chapter 3 is aligned with existing research on achievement goals in students (Scherrer et al., 2024). Sherrer and colleagues (2024) suggested that students' reduction in goals can be due to their reciprocal relationship to academic interests, but these were accurate predictors of academic performance. However, in Chapter 4 of this thesis, achievement goals failed to predict academic performance.

A separate longitudinal study on the role of achievement goals in control over academic performance argues for the importance of mastery and performance goals (Bostan et al., 2022). They found that mastery goals were more effective predictors of motivational persistence and the pursuit of competency development in academic settings. In other words, mastery/performance goals as opposed to approach/avoidance goals may be an alternative way to consider the influence of goals on academic

performance and wellbeing. Whilst the programme of research in this thesis applied an approach/avoidance perspective to goals as challenge/threat resource appraisals in HE, it may be better suited for future research to consider the mastery/performance goals split.

From a wellbeing perspective, resource appraisals shape motivational and emotional responses to the perceived demands in a performance setting, influencing the experience of stress (Jones et al., 2009). More specifically, a recent systematic review into secondary students' experiences highlighted the importance of student autonomy (a motivational concept grounded in high perceived control over choices and actions; Ryan & Deci, 2000) and cultural environment for students' wellbeing and overall functioning within the academic environment (Jiang et al., 2025).

In conclusion, challenge/threat resource appraisals as formulated by the TCTSA (Jones et al., 2009) may present differently in an academic context. Existing research grounded in motivation has demonstrated the positive influence of academic self-efficacy, control and mastery goals for students' academic performance. The current thesis has extended the evidence base by presenting the common role of resource appraisals across performance and wellbeing in academia. Next, the role of social resources in students' wellbeing and performance will be reviewed.

The role of social support and social identity in a biopsychosocial model of HE students' wellbeing and performance

Recent research has demonstrated that social identity strengthens the relationship between social support and life satisfaction (Gillman et al., 2023). More specifically, while social support was a strong predictor of life satisfaction (concept related to wellbeing), this relationship became stronger in the presence of a shared social identity with their workplace, academic course, sporting team or exercise group. Interestingly, Gillman and colleagues (2023) found that both social support and identity were correlated with and moderated the relationship between challenge/threat resources and life satisfaction. In contrast, all three studies in this thesis demonstrated an inconsistent correlation between resources and social identity, as well as between wellbeing and social identity. Nevertheless, social support was

consistently correlated with wellbeing. This evidence can be interpreted as a lack of evidence for a direct impact of social identity on wellbeing. Whilst the aim of this body of research was to test the complete biopsychosocial formulation (TCTSA-R), future research can utilise moderation analyses to examine the individual interactions within the biopsychosocial TCTSA-R, which could provide confirmatory evidence for an indirect influence of social identity on wellbeing.

From a performance perspective, the three studies in this thesis offer limited support for a direct influence of social support and social identity on academic performance. Historically, research has supported the buffering effect hypothesis, which postulates that social support can moderate the effect of stress on performance (Cohen et al., 2000). More specifically, higher perceived availability of social support is predictive of high self-efficacy and better performance in athletes (Freeman & Rees, 2008; Freeman & Rees, 2010). However, correlations from Chapter 3 demonstrate that multidimensional social support at the beginning of the year is correlated with performance predictions. In Chapter 3, social identification with the university was positively correlated with self-efficacy. Finally, in Chapter 5, social support is only correlated positively with self-efficacy and control. Despite these correlations, social resources (support and identity) failed to predict students' academic performance.

Alternatively, formulations of these relationships should consider the possibility of bidirectional relationships. Achieving well in academia historically may be an influential factor in how much students share in an academic social identity. For example, a longitudinal study into the development of an academic social identity found that academic achievement predicted the development of adolescents' identity, resulting in high levels of commitment to studies later (Pop et al., 2016). Separately, the current body of research focuses explicitly on the stress-buffering influence of social support on academic performance. However, the buffering influence of social support on academic performance can occur via mechanisms such as motivation, engagement, and environmental adjustment (Chun-mei et al., 2023; Hassan et al., 2023).

Finally, a few contextual factors concerning student identity warrant discussion. Participants across the three empirical studies in this thesis represent a varied age group, where the mean age in Chapter 3, for example, was 24.95 ± 8.41years. Of these participants, around 15% disclosed living with a disability, and 52% were the first in their family to attend university. These statistics alone can be interpreted to suggest that the population tested may be motivated to pursue HE for social mobility reasons, as well as the presence of additional personal commitments (i.e., older students are more likely to have care and other work priorities). For example, a 19-year-old attending university for the experience and development may prioritise their student identity differently compared to a 29-year-old attending university to seek a career transition that will better support their family. Whilst it would be beyond the scope of this thesis to explore the changing demographics of university students, these sociological factors may play a key role in how students' social identity (and their academic self-efficacy) develops throughout their academic journey.
Across the three studies in this thesis, perceived social support availability showed a stable, positive and direct influence on wellbeing and positive affect, but not on performance expectations or actual grades. In other words, perceived availability of social support acted primarily as a predictor for psychological wellbeing rather than as a driver of academic performance. Separately, a shared social identity with the university failed to predict wellbeing or performance. Furthermore, social identity scores declined over the academic year and was a negative predictor of performance in Chapter 3. These findings, alongside differential research evidence, present mixed support for the impact of social resources suggested by TCTSA-R (Meijen et al., 2020). Next, the role of irrational performance beliefs (i.e., cognitive predispositions) in students' wellbeing and performance will be reviewed.

The role of irrational performance beliefs in a biopsychosocial model of HE students' wellbeing and performance

Across the first two studies in this thesis, irrational performance beliefs exerted a consistent negative influence on students' wellbeing and in Chapter 4, on positive affect. However, irrational performance beliefs had a

limited and inconsistent influence on students' academic performance predictions and their actual grades. In other words, students who reported high irrational performance beliefs also reported significantly lower wellbeing across the academic year (Chapter 3) and positive affect before academic assessment (Chapter 4). This supports the conceptualisation of irrational beliefs as a psychological vulnerability within the biopsychosocial model of HE students' wellbeing and performance, affecting students' affective experiences more than their grades.

As reviewed in chapter one, irrational beliefs, as described in rational emotive behaviour therapy (REBT), involve rigid, extreme, and unrealistic beliefs about oneself and possible outcomes. In the academic environment, particularly among students, these beliefs can manifest as perfectionism, intolerance of setbacks, and harsh self and other evaluations (Ellis, 1957). In the TCTSA-R (Meijen et al., 2020), irrational beliefs have been identified as predispositions to challenge/threat appraisals and responses. Both athletes (Chadha et al., 2019; 2023) and HE students (Turner et al., 2024) who rate high for irrational performance beliefs are predisposed to appraising motivated performance situations as a threat, rather than as a challenge. However, the mechanisms through which irrational beliefs influence challenge/threat appraisals are still being studied and understood

For example, Turner and colleagues (2024) suggested that low irrational beliefs, higher challenge appraisals, and lower threat appraisals represent a favourable appraisal profile in HE students. This favourable appraisal profile is, in turn, related to lower anxiety and greater positive affect reported by students, as well as a positive academic self-concept (i.e., self-reported assessment performance; Turner et al., 2024). Interestingly, and similar to evidence presented in challenge/threat research (Malkoc et al., 2024), appraisals exert an indirect influence on academic performance through their effect on affect. The correlations presented in chapters three and four failed to offer support for a correlation between affect and performance. However, irrational performance beliefs were correlated with predicted performance in Chapter 4.

Cognitive-behavioural techniques, such as REBT, are widely used in athletic and other performance environments to enhance individuals' functioning and

performance outcomes (e.g., Wood et al., 2021). Chapters two and three in the current thesis highlight the role that cognitions, in this case, irrational beliefs, can play in HE students' assessment experiences and wellbeing across the academic year. Interventions targeting cognitive change, especially irrational performance beliefs, represent a viable pathway to enhancing students' wellbeing and, in some cases, academic performance. For example, a recent study by Sparks and colleagues (2025) conducted a six-week psychoeducation program with secondary school and college students, comparing the wellbeing and performance of intervention participants to those of a control group. More specifically, they educated their intervention group participants about a multimodal cognitive behavioural approach to exam stress, which included stress-mindset, challenge/ threat appraisals, irrational beliefs, self-compassion, and imagery. Their results demonstrated significant changes in students' stress-mindset, proactive coping, and perceived academic performance. This research represents an alternative intervention approach to the one adopted by Chapter 5 of this thesis. A benefit of taking a biopsychosocial perspective on student wellbeing and performance is that there are multiple pathways to improvement, e.g., social, psychological and physiological.

6.3. Applied implications

6.3.1. A Biopsychosocial examination of the impact of a COPDMS intervention on HE students' resource appraisals, social support availability and social identity.

Chapter 5 is a biopsychosocial examination of a COPDMS intervention delivered with HE students. The findings from a social validation perspective were similar to those of other COPDMS research (Evans et al., 2022), however, the psychometric findings provide mixed evidence for the intended psycho-social impact of the intervention. For example, Evans and colleagues (2019) developed the coping-oriented version of a PDMS intervention to influence group members' personal self-efficacy and group closeness positively. More specifically, the researchers theorised that by preparing and delivering speeches about successful coping experiences, students would

come to appraise their personal resources as sufficient to meet the demands of transitioning into HE (Evans et al., 2022). The mixed findings of existing research and Chapter 5 of this thesis suggest that participants learned about their fellow group members, but this did not lead to significant increases in perceptions of social support availability, nor the development of a shared group identity.

Interestingly, in Chapter 5, control group participants reported increased perceptions of social support availability following the control group activity (i.e., study skills session). These findings align closer to an optimal matching hypothesis of perceived social support availability (Cutrona, 1990; Cutrona & Russell, 1990). More specifically, at the start of the academic year, students are more likely to perceive higher social support availability when the specific support made available/salient matches the prevalent contextual demand (i.e., academic performance). Additionally, analysis of students' resource appraisals in Chapter 5 revealed them to be stable variables across time (from baseline to post-intervention, to follow-up), similar to Chapter 3 (from the start to the middle, to the end of the academic year).

One alternative explanation suggests that at the beginning of the academic year, students may benefit more from enhancing their resource appraisals (e.g. academic self-efficacy, control, achievement goals) directly. Indeed, Dun and Holt (2004) and later reviews (Warburton et al., 2024) suggested that PDMS is best delivered with a group already familiar with one another and brought together by the pursuit of a common goal. Per se, PDMS and COPDMS could improve resource appraisals, performance and wellbeing indirectly via better group functioning. As a result, COPDMS may not be an effective way to enhance HE students' resource appraisals, perceptions of available social support, wellbeing or performance. Instead, interventions could focus on developing students' academic resource appraisals and may include social relationships development as a secondary element.

6.3.2. Applied interventions to enhance HE students' resource appraisals, social support availability and social identity.

A key benefit of a biopsychosocial formulation of student wellbeing and performance based on TCTSA-R principles lies in the broad spectrum of possible interventions. For example, social relationship building interventions (e.g. PDMS) can be tested under the theoretical framework of TCTSA-R as well as cognitive-behavioural interventions (e.g., Sparks et al., 2025), or direct interventions for improving students' resource appraisals. Evidence-based practitioners and HE educators can design informed interventions to match the specific educational context, such as the development and later testing of COPDMS with students transitioning into HE (Evans et al., 2019; 2022). Whilst the suggested biopsychosocial formulation of student wellbeing and performance in this thesis is not without flaws and limitations, the three empirical studies offer key learning points that could support the development and biopsychosocial examination of psychological or social interventions aimed at improving students' experience and achievement.

For example, across the three studies in this thesis, self-efficacy has emerged as a key resource appraisal across student wellbeing and performance. Other research that has prioritised academic skill development in students has been successful in enhancing student outcomes. For example, a four-week intervention with nursing and midwifery students designed to improve their academic skills led to significant increases in academic self-efficacy and motivation (Kordsalarzehi et al., 2025). Whilst this study exemplifies the importance of academic skills training for students, a similar intervention may have positive implications for students' wellbeing and overall academic performance, on the basis that it enhances self-efficacy, which is a predictor of student wellbeing and academic performance (Chapter 3).

Alternatively, cognitive-behavioural interventions such as Sparks and colleagues (2025) can be utilised to teach a broad spectrum of psychological coping skills, such as imagery, that can help students optimise relaxation and performance in and around assessment.

6.4. Strengths and limitations

The theory of challenge and threat states in athletes (TCTSA; Jones et al., 2009; Meijen et al., 2020) has been increasingly applied in performance contexts, including HE. The challenge and threat states and the related concept of coping can be a valid theory to understand students' responses to academic stressors, such as assessments, examinations (Turner et al., 2024), transitions (Evans et al., 2022), and building new social connections (Smith & Hopkins, 2005; Zwettler et al., 2018). This thesis adds to the understanding and expansion of the stress and performance literature and its applicability to the HE context in several ways.

First, the current programme of research is grounded in a holistic biopsychosocial approach to human performance and wellbeing. This is important as challenge and threat theories have been argued to apply across motivated performance contexts to impact on how individuals appraise situational demands and coping resources, experience the resultant psycho-physiological activation, and performance . As a result, challenge and threat theory has been applied to athletic, occupational, and academic performance contexts, resulting in evidence of the positive influence of appraising stress as a challenge as opposed to a threat. More specifically, the absence of stress is not where individuals experience high levels of wellbeing and perform effectively. Instead, stress at the level that can be approached adaptively (challenge state) is where people experience high levels of wellbeing and perform to their best. The adaptive response to stress has been researched at the physical, psychological and social perspectives, with recent formulations taking a biopsychosocial perspective, aiming towards understanding how these perspectives interact with one another towards performance and wellbeing. In taking a biopsychosocial perspective, we are better able to understand the processes and their dynamic interactions, as well as the impact of intervention.

Second, the empirical studies in this thesis are among the few that have explored the biopsychosocial application of challenge and threat theory with HE students. This is important as individuals spend a significant part of their lives in education, often with the goal of developing new skills and improving

their socio-economic standing (Amadi et al., 2025). As such, academia can present as a motivated performance context where learners are faced with skill-appropriate levels of learning and stress, allowing them to develop in their knowledge as well as in their capacity to handle stress. The presented body of research studies challenge and threat appraisals and responses in HE students via three different lenses: 1) A macro lens – across an academic year; 2) A micro lens - on approach to academic assessment, a real-life presentation assignment; and 3) An intervention lens – students' response to a COPDMS intervention; thus testing the validity of the theoretically suggested constructs of resource appraisals, social resources, and cognitive predispositions (Meijen et al., 2020).

Third, the presented research benefits from a multi-method approach and high ecological validity. More specifically, it integrates field-based, cross-sectional, longitudinal, physiological, experimental and qualitative data collection across the three empirical studies towards expanding the application of challenge and threat theorising to the motivated performance context of HE. From a field-based repeated-measures perspective, the three studies present consistent support for some of the suggested resource appraisals (TCTSA; Jones et al., 2009), highlighting them as temporally stable characteristics. Moreover, few studies have previously considered social resource appraisals (social support and social identity) together with cognitive predispositions (irrational performance beliefs) and examined their combined influence on challenge and threat states, wellbeing and performance (Meijen et al., 2020). In testing the complete biopsychosocial theoretical formulation, the current body of research has highlighted areas of inconsistency, methodological and applied limitations. For example, social identification with a HE institution may decline over time and not continuously operate as a facilitator for performance.

Where most research has considered HE students' performance and wellbeing in isolation from one another, the present thesis considers them in parallel. This is an important step towards a holistic understanding of how HE students cope with stress during their studies. Studying the common grounds where wellbeing and performance align can highlight key target interventions for improving students' experience and outcomes. More specifically, chapters

two and three highlight that social resources and cognitive predispositions (Meijen et al., 2020) are more likely to impact challenge/threat responses and academic performance, indirectly, potentially via enhancing wellbeing.

Finally, the research in chapters three and four adopts complex experimental designs including cardiovascular markers of challenge and threat (i.e., CO and TPR). This allowed for the examination of physiological measures of stress whilst establishing the role of psychological and social factors. To date, there have been few studies that utilise a physiological approach towards studying challenge and threat responses in students and present mixed findings (e.g., Seery et al., 2010; Smith et al., 2022). Furthermore, in these existing studies, participants were tasked with speech delivery tasks while their responses were recorded. Chapter 4 offers greater ecological validity in comparison due to measuring participants' responses to a real-life assessment taking place shortly after the measurement. In turn, Chapter 5 benefits from a highly transparent analytic strategy where repeated measures, hierarchical regressions and social validation offer a triangulated quantitative and qualitative evaluation process.

Despite the strengths, ambitious methodology and novel findings, the present research is not without limitations. First, while the three empirical studies aimed to optimise ecological validity, the experimental part of chapters three and four measured participants' responses to stressor instructions and a two-minute mental/thinking task. Given the intricate setup for measuring cardiovascular indices of challenge and threat (CO and TPR), it would have been difficult to take these measurements during the assessment performance or intervention itself. For example, participants would be highly limited in their physical movement, which may present as a distraction to the actual presentation performance. However, some challenge and threat research has measured students' CO and TPR pre, during and post-course assessment performance (Zanstra et al., 2010). Despite achieving higher ecological validity and observing a larger stress response, comparable to Chapter 4, Zanstra and colleagues (2010) observed similar results, namely participants' responses followed the theorised direction, but the differences failed to reach statistical significance. Notably, real-world

stressors appear to elicit a measurable stress response based on CO/TPR changes, in some cases, a greater response than that observed in response to lab-based stressors (Zanstra & Johnston, 2011). With the development of technology, future research should aim to study real-world stressors to uncover the influence on performance and wellbeing in a motivated performance context.

Second, some of the key strengths of the three empirical studies carry inherent limitations, as part of the study design and methodology. For example, the repeated measures design adopted in chapters two and four saw high attrition rates in participant responses, limiting power for some analyses. Notably, research has utilised analytical techniques that limit the impact of attrition, such as data imputation (e.g., Chadha et al., 2023; Turner et al., 2024). However, these carry inherent limitations and do not eliminate the influence of leverage in the dataset. The repeated cross-sectional measurement across time points and the three studies in this thesis offer better transparency.

Third, while a repeated cross-sectional analysis, as opposed to data imputation, is more transparent, it simultaneously limits the ability to utilise more sophisticated statistical modelling methods (e.g., structural equation modelling) that are more likely to portray the interaction of variables. Similarly, the achieved sample sizes for the physiological arms of the studies have a reduced capacity to detect small effect sizes. A recent meta-analysis of challenge and threat suggests that CO and TPR have a small but stable effect size on performance (Hase et al., 2025).

Fourth, factors such as participant volunteer bias and self-selection bias are often inherent in research and may unintentionally exclude participants, despite reasonable measures. Whilst the three studies collected data from a broad demographic spectrum, specific characteristics may still be underrepresented. For example, all participants were from the same university. These limitations are of key importance because research attempting to model holistic, biopsychosocial frameworks is more likely to require the measurement of a broader spectrum of variables repeatedly, presenting a significant participant and research burden. As such, future biopsychosocial research should consider measurement burden.

Finally, intervention dosage has been a key consideration in PDMS research. A single session of sharing, especially framed in the constraints of empirical research, offers a limited opportunity for participants to foster the necessary connections and experience the intended benefits of the intervention. PDMS research, including multiple sessions delivered with the same group (e.g., Lynch et al., 2023; Pain & Harwood, 2009; Piasecki et al., 2021), has observed greater and measurable changes in participants' confidence, closeness, and group interactions (Warburton et al., 2024). Furthermore, where COPDMS within HE transitions has been evidenced to bring forward some qualitative benefits (Evans et al., 2022), the positive impact may be limited by contextual factors. For example, where PDMS was initially developed as an intervention for sports teams, these are often guided by common goals of team coherence and competitive outcomes.

In contrast, HE students may share common goals of development and academic performance, which are predominantly personal in nature. This contrast between motivations (group vs. personal), alongside the nature of the performance context (competitive vs. developmental), may imply a different hierarchy of priorities/needs. Where a sports team needs high team coherence, HE students may need high academic self-efficacy to meet the demands of their respective contexts. In other words, intervention research would benefit from a contextually grounded needs analysis to define the key priorities of the research population.

6.5. Future research directions

The current thesis provides an original contribution to knowledge by examining the wellbeing and performance of HE students from a biopsychosocial challenge and threat responses to stress perspective. Evidence was found to suggest that personal resource appraisals, as outlined in TCTSA (Jones et al., 2009) and social resources and cognitive predispositions, as outlined in TCTSA-R (Meijen et al., 2020), influence students' wellbeing directly (all empirical chapters), but not their academic performance (chapters two and three). Furthermore, cardiovascular indices of challenge and threat (Blascovich et al., 2004) may not be effective

predictors of academic performance in HE (Chapter 4). As a result, the findings suggest several avenues for future researchers. First, the most significant area of research is to recognise and establish the context-specific appraisals that influence students' academic experiences. The identification of specific resource appraisals applicable to athletic performance by the TCTSA has been instrumental in developing targeted interventions and measures of effectiveness. However, some of the sport-specific resource appraisals have been effective predictors in academia (e.g., self-efficacy), while others have failed to predict performance and wellbeing (e.g., control) consistently.

Second, the role of social support and social identity as social resources alongside established challenge and threat frameworks should be considered in more detail. More specifically, the operationalisation of social appraisals of support availability and social identity is key, as their emergence often interacts with other contextual variables. For example, social support effectiveness can be influenced by (a) timing (the when); (b) the support provider (the who); (c) the type of support (the what); and (d) the effectiveness (the how; Gleason & Iida, 2015). In the context of HE, more specifically at the start of the academic year, students are more likely to increase their perceptions of the availability of social support through the provision of academic skills support (Chapter 5 of the current thesis; Kordsalarzehi et al., 2025) in comparison to engaging in peer sharing (Chapter 5 of the current thesis). Conversely, the feasibility of a COPDMS intervention at the start of the academic year in HE should be questioned. Where the initial evidence has been promising (Evans et al., 2022), researchers of PDMS in HE should consider intervention timing, number of sessions and type of PDMS instructions.

Third, researchers should consider alternative intervention avenues based on a biopsychosocial perspective and provide an empirical comparison for the influence of different interventions. Cognitive-behavioural (Sparks et al., 2025) and educational (Kordsalarzehi et al., 2025) interventions delivered in academic settings have resulted in measurable improvements in students' self-efficacy, motivation, and performance. Larger-scale implementations of interventions in HE could serve to inform not only future research and

applied work, but could also shape policies that improve student experience and the academic profile of an educational institution.

Fourth, the interaction of performance and wellbeing within a biopsychosocial formulation of challenge and threat should be explored. Few studies have considered the interaction of wellbeing and performance in motivated performance environments, but many recognise or mention its importance. For example, a longitudinal study of adolescent students found that academic performance positively predicted students' mental health two years later but not vice versa (Monzonís-Carda et al., 2024). Additionally, when predicting academic performance using challenge and threat theory, specifically social identity, some research suggests that high academic performance is a predictor of academic identity (Pop et al., 2016).

Finally, in planning, delivering and writing up the three empirical studies in this thesis, several practical considerations can be offered for future research. For instance, the research design of chapters three and four can be replicated across multiple cohorts of students, institutions and academic years, thereby increasing statistical power and demographic representation. Alternatively, engaging a team of researchers may be an effective way to achieve the same result. From an analysis perspective, applying high-level statistical analysis techniques may be useful to understand some of the nuanced interactions between the constructs (i.e., resource appraisals, social resources and cognitive predispositions). For example, other fields (e.g., medical research; Almuqrin, 2024) greatly benefit from the application of mathematical and statistical skills and techniques that enable them to identify patterns and advance the field. While individual differences on a biological, psychological and social level exist, statistical analytical methods can help us understand these better. Research in HE and in psychology shows that advanced statistical models improve understanding of student learning, mental health, and dropout risk by analysing complex longitudinal data (e.g., Malkoc et al., 2022; Moreno & Tamara, 2024; Turner et al.,2024). Such models help identify key factors influencing retention, guiding targeted interventions (Evans et al., 2022). For example, multilevel modelling can integrate individual, social, and institutional factors to tailor interventions addressing diverse student needs, improving academic success and

wellbeing. These quantitative methods are vital for evidence-based policies and practices that enhance outcomes in higher education and reduce dropout (Moreno & Tamara, 2024).

6.6. Conclusion

The current thesis makes a novel contribution to challenge and threat theory, social support, and irrational performance beliefs literature. One of the key contributions of this programme of research is the biopsychosocial examination of student wellbeing and performance in parallel from a longitudinal perspective, in relation to academic assessment, and in the biopsychosocial evaluation of a COPDMS intervention delivered with HE students. In turn, this thesis contributes to advancing knowledge in the areas of stress, performance, and wellbeing by better understanding the role of personal resource appraisals, the role of social support, and irrational beliefs in the human stress response to a motivated performance environment. In summary, through the repeated measures utilised within and across the three empirical studies, there was evidence of psychosocial predictors (e.g., self-efficacy, social support and irrational performance beliefs) of wellbeing in line with the TCTSA-R. However, these same psychosocial antecedents failed to predict academic performance and cardiovascular responses to challenge and threat in HE students, which warrants further investigation. There was longitudinal evidence of the positive influence of self-efficacy on both student wellbeing and performance.

Additionally, there was longitudinal evidence of the positive impact of social support on student wellbeing and an adverse effect of irrational performance beliefs on student wellbeing. These studies extend past research by utilising established challenge and threat paradigms and testing their extended biopsychosocial formulation to examine the interplay between these biopsychosocial factors. Future researchers can adopt a biopsychosocial formulation of challenge and threat responses and their role in improving student wellbeing and performance.

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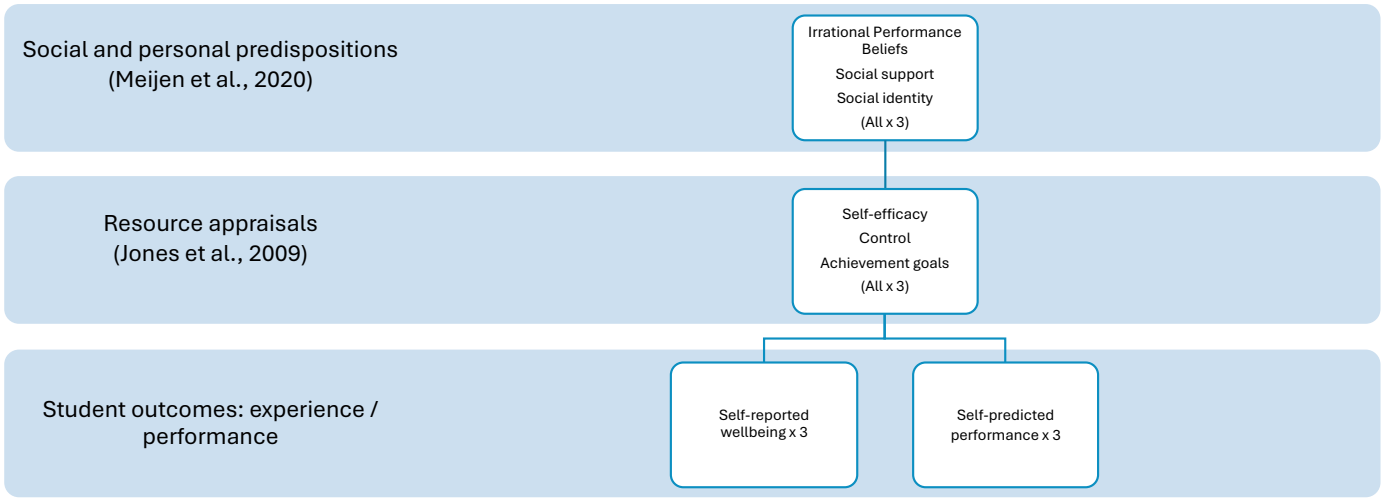
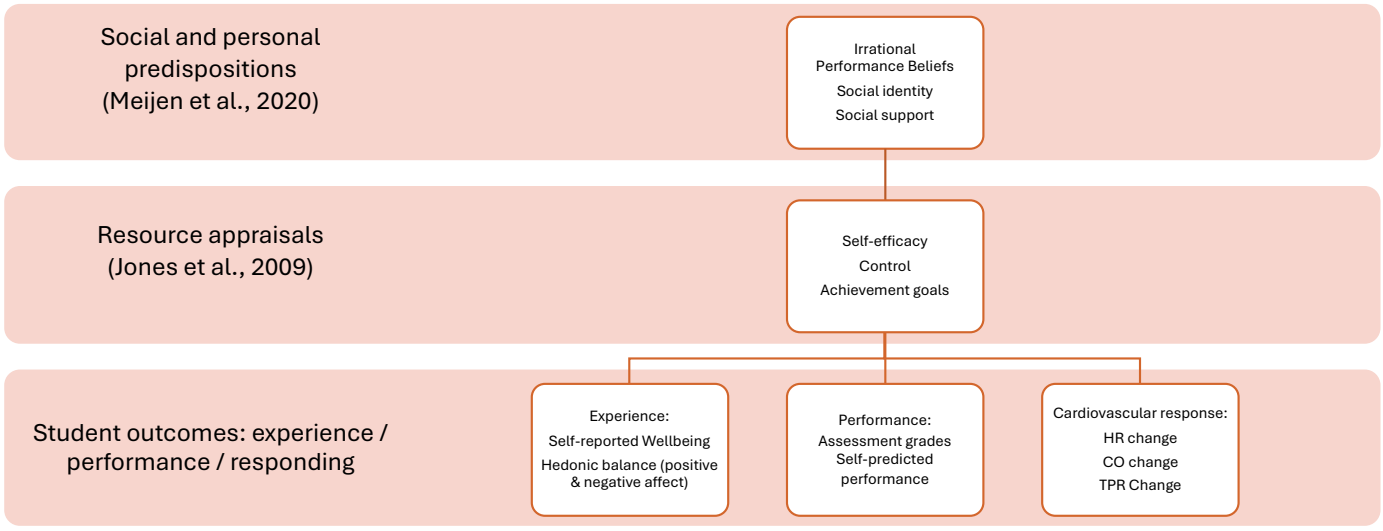
Appendix: Study Variables Graph

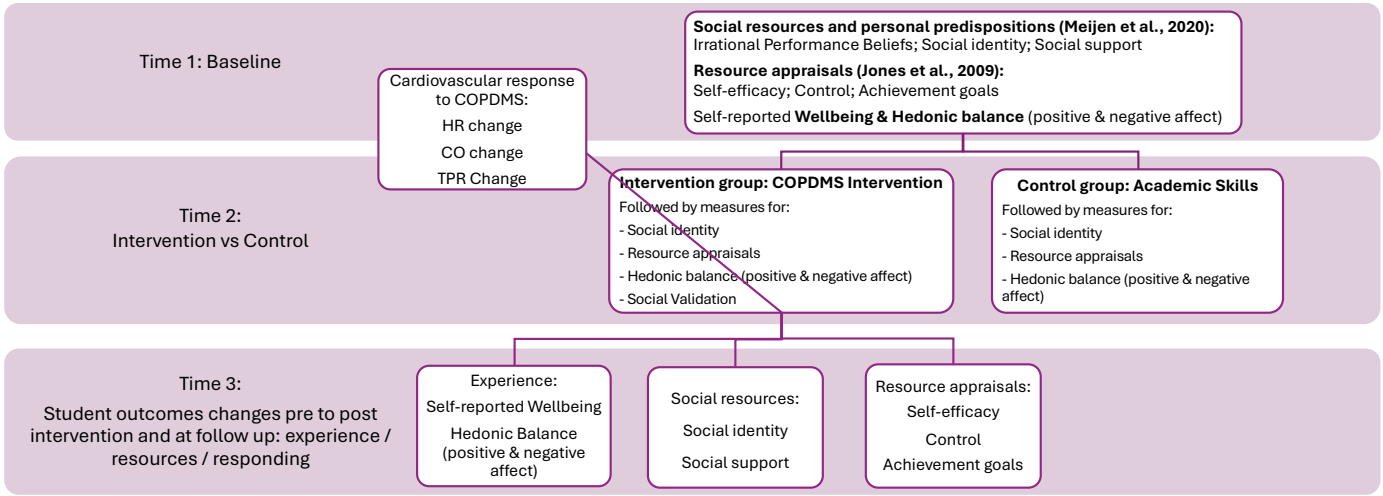
Chapter Two



Chapter Three



Chapter Four



Appendix: Ethical Approval for the three studies

Life Sciences and Education

ETHICAL APPROVAL FEEDBACK

Researcher name:	Tsvetelina Nikolaeva Ivanova
Title of Study:	Antecedents of challenge and threat states and their impact on wellbeing, burnout and academic achievement in university students: A longitudinal study.
Status of approval:	Approved (NOTE)

Note: Please reconsider the choice of "Queer" in the demographic questionnaire as it may be considered as offensive by some participants.

Thank you for addressing the committee's comments. Your research proposal has now been approved by the Ethics Panel and you may commence the implementation phase of your study. You should note that any divergence from the approved procedures and research method will invalidate any insurance and liability cover from the University. You should, therefore, notify the Panel of any significant divergence from this approved proposal.

You should arrange to meet with your supervisor for support during the process of completing your study and writing your dissertation.

When your study is complete, please send the ethics committee an end of study report. A template can be found on the ethics BlackBoard site.

Signed: Prof. Roozbeh Naemi **Date: 08.06.2021**

Ethics Coordinator
School of Life Sciences and Education

Life Sciences and Education

ETHICAL APPROVAL FEEDBACK

Researcher name:	Tsvetilina Nikolaeva Nenkova
Title of Study:	The impact of psycho-social resources on challenge and threat states, wellbeing and academic assessment performance in a cohort of university students.
Status of approval:	Approved

Thank you for addressing the committee's comments. Your research proposal has now been approved by the Ethics Panel and you may commence the implementation phase of your study. You should note that any divergence from the approved procedures and research method will invalidate any insurance and liability cover from the University. You should, therefore, notify the Panel of any significant divergence from this approved proposal.

You should arrange to meet with your supervisor for support during the process of completing your study and writing your dissertation.

When your study is complete, please send the ethics committee an end of study report. A template can be found on the ethics BlackBoard site.

Signed: Prof. Roozbeh Naemi **Date: 24.02.2022**

Ethics Coordinator
School of Life Sciences and Education

School of Health, Science and Wellbeing

ETHICAL APPROVAL FEEDBACK

Researcher name:	Tsvetelina Nikolaeva Nenkova
Title of Study:	The BPS-W project: a Biopsychosocial examination of Student Wellbeing.
Status of approval:	Approved

Thank you for addressing the committee's comments. Your research proposal has now been approved by the Ethics Panel and you may commence the implementation phase of your study. You should note that any divergence from the approved procedures and research method will invalidate any insurance and liability cover from the University. You should, therefore, notify the Panel of any significant divergence from this approved proposal.

You should arrange to meet with your supervisor for support during the process of completing your study and writing your dissertation.

When your study is complete, please send the ethics committee an end of study report. A template can be found on the ethics BlackBoard site.

Signed: **Date: 07.09.2022**

Prof. Roozbeh Naemi

Ethics Co-ordinator
Sport and Exercise
Biological Sciences
School of Health, Science and Wellbeing

Appendix: Chapter 3

Participant Information Sheet

Study Title: Antecedents of Challenge and Threat States and their impact on Wellbeing and Academic Achievement in university students: a longitudinal study.

Who is doing this research?

The research will be conducted by Tsvetelina Nenkova, a Sport, Exercise & Performance Psychology PhD researcher at Staffordshire University.

What is the research about?

I am conducting a study looking at stress & coping across the academic year, and how they impact the wellbeing and academic achievement.

Why am I being invited to participate?

You are currently a Staffordshire University student.
Over the age of 18.

What is required of me?

I am asking you to take part in a study lasting approximately 15-20 minutes.

- Complete a survey today and consider completing it 2 more times throughout the academic year (three times in total; see timelines for the 3 waves below).
- Provide your student email and student number (so that I can follow up with you for the repeat survey, and to be entered into the amazon voucher prize draw).

Weeks 1 to 4 of 21/22 academic year: Study 1st wave

Weeks 12 to 16 of 21/22 academic year: Study 2nd wave

Weeks 22 to 26 of 21/22 academic year: Study 3rd wave

In addition to the above, but ***not a prerequisite for your participation*** you may give your permission for your grades from this academic year to be added to your data. This will allow the study to find out how wellbeing and academic achievement are related.

Where will the study take place?

The study will take place at Staffordshire University, completing the survey either electronically (via a Qualtrics survey web link on your phone or computer), or on paper and handed back to your tutor or the researcher directly.

I know a friend who may be interested; can they participate in your study?

Yes, as long as your friend meets the criteria mentioned above. Your friend should contact the PhD researcher directly to discuss the study and make arrangements for them to take part. Contact details are given below.

What if I want to drop out?

If you wish to drop out at any stage during the study, then please just let me know. If you wish to withdraw your data during or after the study you can do this, without any consequences, up to 7 days after the study has ended (end of the academic year), by contacting the researcher (details below) and providing your student number and email (so that your data can be located and deleted).

Will the information I give you be kept confidential?

The information obtained will be treated with the strictest confidence throughout the study and the data will be stored safely in a secure location to which only the researcher has access.

Although you will be providing information about yourself, the information collected will be strictly confidential. You will be issued a participant number to maintain anonymity in subsequent analyses. Your student number/email, or any identifying information will not be included in any reports.

Note: your contact information (student number and email) will only be used for one of three reasons:
(1) to follow up with the next waves of the study throughout the year;
(2) to help locate and delete your data should you request to withdraw;
and (3) to enter you into the prize draw and contact you should you win the prize draw.

What if I don't want to answer any questions?

If you do not wish to answer any of the questions that are included in the study, you are free to do so, without penalty.

What if I am upset by anything during the study?

If this happens, you might like to take a break, or if you prefer, you can decide to end your participation and withdraw from the study at that point. If you decide to withdraw, a copy of the debriefing sheet can be sent to you on request. Additionally, bellow are details where you can reach out for wellbeing and mental health support.

Who will have access to my data?

Only the PhD researcher and the researcher's supervisor will have access to the raw data.

Who will see the finished report?

All data in the finished report will be presented in the form of group statistics. The final report will be seen by the researcher's supervisor and assessors from the sport & exercise department, graduate school, and possibly by an external examiner. In addition, the completed PhD report may also be made available to future Staffordshire University students for teaching/reference/audit purposes and/or may feature in scientific journal publications.

What will happen to my responses to the study?

All data will be kept in secure storage (to which only the researcher has access) for up to ten years, according to departmental policy, and it will be destroyed after that.

Approval for this study and complaints procedure?

Approval for this study has been granted by Staffordshire University, Division of Psychology, Sport and Exercise, Ethics Committee.

Should you wish to raise a complaint/concern in relation to this study you can do so in confidence by getting in touch with the Director of Research Dr Tim Horne (Research, Innovation and Impact Services, Cadman Building, Staffordshire University, College Road Stoke-on Trent, ST4 2DF; Tim.horne@staffs.ac.uk and/or +441782295722)

GDPR Statement

The following statement should be added to all information sheets circulated to research participants, except where a collaborating organisation specifies a different form of words:

Your data will be processed in accordance with the General Data Protection Regulation 2016 (GDPR).

The data controller for this project will be Staffordshire University. The university will process your personal data for the purpose of the research outlined above. The legal basis for processing your personal data for research purposes

under the GDPR is a 'task in the public interest'. You can provide your consent for the use of your personal data in this study by completing the consent form that has been provided to you.

You have the right to access information held about you. Your right of access can be exercised in accordance with the GDPR. You also have other rights including rights of correction, erasure, objection, and data portability. Questions, comments, and requests about your personal data can also be sent to the Staffordshire University Data Protection Officer. If you wish to lodge a complaint with the Information Commissioner's Office, please visit www.ico.org.uk.

If you have been affected by some of the issues raised in this study, and would like to talk to someone in confidence about it, you may wish to contact the following service(s) for support (the link bellow includes both internal and external support avenues):
https://www.staffs.ac.uk/students/support/student-wellbeing You can get in touch by telephone on 01782 294976 or studentwellbeing@staffs.ac.uk.

Is there anyone I can talk to about the study before I take part?

If you wish to talk to someone else about this study before taking part, then please feel free to contact the PhD researcher or the project supervisor:

Supervisor contact details:
Name: Matthew Slater
Email: M.Slater@staffs.ac.uk
Phone: 01782 294498

If you have any further questions, please do not hesitate to contact me.

Researcher Contact Details:

Name: Tsvetelina Nenkova
Email address: i027287k@student.staffs.ac.uk
Department of Sport and Exercise
Staffordshire University
ST4 2DF

You can complete the survey on your phone by scanning the Survey QR code ->

Welcome!

On the following pages, you will have a chance to provide your *informed consent* to proceed with the study & an entry in the prize draw!

Project Title: **The BPS-W Project** (BioPsychoSocial - Wellbeing)

Study Title: **Antecedents of Challenge and Threat States and their impact on Wellbeing and Academic Achievement in university students: a longitudinal study.**

Please, contact the researcher with any questions or concerns.
Researcher Name: Tsvetelina Nenkova
Email: t.nenkova@research.staffs.ac.uk

Supervisor Name: Matthew Slater
Email: M.Slater@staffs.ac.uk

"I have read the Participant information sheet and wish to proceed with the study."

- ☐ Proceed
- ☐ Leave study

About you

Student Number (e.g., 10004652)	
Student email	
What is the name of your course?	
Your date of birth (e.g., 02/04/1992)	
How many siblings have you got?	

Participant Consent form

I give my permission to the researcher to look up my academic grades for the current academic year, for the purpose of this research.

☐ I give my permission

☐ I decline my permission, but would still like to participate in the study

Please read the following items carefully and indicate that you have read, understood, and agreed with each item **by giving your informed consent to proceed**, and participate.

- ✓ I am over 18 years of age and I voluntarily agree to participate in a research project conducted and explained to me by the researcher, a Sport, Exercise & Performance Psychology PhD Researcher at Staffordshire University.
- ✓ I have read the information sheet and understand that this research is being conducted as part of a PhD research project.
- ✓ I understand that I am being asked to participate in a study (lasting approximately 15-20minutes) and involves me completing a survey.
- ✓ I understand that I am being asked to provide my student ID and email so that the researcher can follow up with me with regards to completing a survey a maximum of 3 times across the academic year.
- ✓ I acknowledge that the task has been explained to me fully.
- ✓ I have been informed that I may withdraw from participating without penalty if I so wish and my data will be destroyed. I have been informed that withdrawal 7days after the end of the academic year will not be possible.
- ✓ The researcher has offered to answer any questions concerning the research and I have been provided with contact details for both the researcher and his/her supervisor.
- ✓ I understand I will be fully protected in accordance with the Data Protection Act of 2018, and in compliance with the British Psychological Society ethical guidelines, and that my data will be kept confidential and anonymous until they are securely destroyed.
- ✓ I understand that my name and any personal details will be anonymised in any report based on this study.
- ✓ I agree that any of the data I provide may be used in the researcher's report and possibly used for publication in academic journals.
- ✓ I understand that in case the data are used for publication, they will be kept until ten years after the article has been published, and then destroyed.

*I give my **informed consent** to **participate** in this **study** & the **prize draw.***

**Note, you will automatically be entered into the prize draw once you complete the full survey.*

☐ Yes (Proceed with study & prize draw)

☐ No

Wellbeing

Below are some statements about feelings and thoughts. Please tick the box that best describes your experience of each **over the last 2 weeks.**

1	None of the time
2	Rarely
3	Some of the time
4	Often
5	All of the time

Over the last 2 weeks:	**1**	**2**	**3**	**4**	**5**
I've been thinking clearly	○	○	○	○	○
I've been feeling interested in other people	○	○	○	○	○
I've had energy to spare	○	○	○	○	○
I've been feeling confident	○	○	○	○	○
I've been interested in new things	○	○	○	○	○
I've been feeling loved	○	○	○	○	○
I've been feeling close to other people	○	○	○	○	○
I've been feeling optimistic about the future	○	○	○	○	○
I've been feeling good about myself	○	○	○	○	○
I've been dealing with problems well	○	○	○	○	○
I've been feeling useful	○	○	○	○	○
I've been feeling cheerful	○	○	○	○	○
I've been feeling relaxed	○	○	○	○	○
I've been able to make up my own mind about things	○	○	○	○	○

Education

How big of a part is education in your life?

- ☐ Education is currently the main part of my life - there is verry little else I do with my time
- ☐ Education is a big part of my life, but there are other things I spend the same amount of my time on
- ☐ Education is a small part of my life. I have a more important occupation (e.g., full time job, athletic career, care provider, etc.)

	From 0% important to 100% important										
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
How important is education for you?	○	○	○	○	○	○	○	○	○	○	○

	Not at all					Extremely
	1	**2**	**3**	**4**	**5**	**6**
How demanding do you expect your studies to be?	○	○	○	○	○	○
How able are you to cope with the demands of your studies?	○	○	○	○	○	○

	1 Not at all	**2 A little**	**3 Moderately**	**4 Quite a bit**	**5 Completely**
How important is it for you to perform well in your studies?	○	○	○	○	○
To what extent do you feel confident that you can perform well within your studies?	○	○	○	○	○
To what extent do you feel confident that you can fulfil your potential?	○	○	○	○	○

To what extent do you agree with the following statement:	Strongly disagree 1	2	3	4	Strongly agree 5
"The more effort I put into my studies, the better I will do."	○	○	○	○	○

The following statements represent types of goals that you may or may not have regarding your studies:

	Strongly disagree 1	2	3	4	5	6	Strongly agree 7
It is important to me to perform as well as I possibly can	○	○	○	○	○	○	○
I worry that I may not perform as well as I possibly can	○	○	○	○	○	○	○
It is important to me to do well compared to others	○	○	○	○	○	○	○
I just want to avoid performing worse than others	○	○	○	○	○	○	○

Appraisals

We are interested in how much **these statements apply to you**, in the context of **your university studies.**

	Strongly disagree					Strongly agree
	1	2	3	4	5	6
I tend to focus on the positive aspects of any situation	○	○	○	○	○	○
I worry that I will say or do the wrong things	○	○	○	○	○	○
I often think about what it would be like if I do very well	○	○	○	○	○	○
I believe that most stressful situations contain the potential for positive benefits	○	○	○	○	○	○
I worry about the kind of impression I make	○	○	○	○	○	○
I am concerned that others will find fault with me	○	○	○	○	○	○
Overall, I expect that I will achieve success rather than experience failure	○	○	○	○	○	○
In general, I look forward to the rewards and benefits of success	○	○	○	○	○	○
Sometimes I think that I am too concerned with what other people think of me	○	○	○	○	○	○
I feel that difficulties are piling up so that I cannot overcome them	○	○	○	○	○	○
I lack self-confidence	○	○	○	○	○	○
A challenging situation motivates me to increase my efforts	○	○	○	○	○	○
In general, I anticipate being successful at my chosen pursuits, rather than expecting to fail	○	○	○	○	○	○
I worry what other people will think of me even when I know that it doesn't make any difference	○	○	○	○	○	○
I am concerned that others will not approve of me	○	○	○	○	○	○
I look forward to opportunities to fully test the limits of my skills and abilities	○	○	○	○	○	○
I worry about what other people may be thinking about me	○	○	○	○	○	○
I feel like a failure	○	○	○	○	○	○

Beliefs

Here are a set of statements that describe what some people think and believe. Read carefully and indicate how much you agree or disagree with each statement.

	Strongly disagree 1	2	3	4	Strongly agree 5
I have to be viewed favourably by people that matter to me	○	○	○	○	○
I need others to think that I make a valuable contribution	○	○	○	○	○
I absolutely should not be snubbed by people that matter to me	○	○	○	○	○
I must not be dismissed by my peers	○	○	○	○	○
I have to be respected by my peers	○	○	○	○	○
I can't stand not reaching my goals	○	○	○	○	○
I can't bear not succeeding in things that are important to me	○	○	○	○	○
I can't stand failing in things that are important to me	○	○	○	○	○
I can't bear not getting better at what I do	○	○	○	○	○
I couldn't stand it if my competencies did not continually develop and improve	○	○	○	○	○
It's awful if others think I do not make a valuable contribution	○	○	○	○	○
It would be terrible to be dismissed by my peers	○	○	○	○	○
It is appalling if others do not give me chances	○	○	○	○	○
It would be awful if my position on my course was not secure	○	○	○	○	○
It's terrible if my peers do not respect me	○	○	○	○	○
If others think I am no good at what I do, it shows I am worthless	○	○	○	○	○
If I face setbacks it goes to show how stupid I am	○	○	○	○	○
I am a loser if I do not succeed in things that matter to me	○	○	○	○	○
If my position on my course was not secure, then it would show I am worthless	○	○	○	○	○
If my competencies did not continually develop and improve, it would show what a failure I am	○	○	○	○	○

Identity

We are interested in how much you identify with being a Staffordshire University student.

	Strongly disagree 1	2	3	4	5	6	Strongly agree 7
I identify as a Staffordshire university student	○	○	○	○	○	○	○
I feel committed to Staffordshire university and my course	○	○	○	○	○	○	○
I am glad to be a Staffordshire university student	○	○	○	○	○	○	○
Being a Staffordshire University student is an important part of how I see myself	○	○	○	○	○	○	○

Social Support

Read each statement carefully and indicate how you feel.

	Strongly disagree 1	2	3	4	5	6	Strongly agree 7
There is a special person who is around when I am in need	○	○	○	○	○	○	○
The is a special person who whom I can share my joys and sorrows	○	○	○	○	○	○	○
My family really tries to help me	○	○	○	○	○	○	○
I get the emotional help and support I need from my family	○	○	○	○	○	○	○
I have a special person who is a real source of comfort to me	○	○	○	○	○	○	○
My friends really try to help me	○	○	○	○	○	○	○
I can count on my friends when things go wrong	○	○	○	○	○	○	○
I can talk about my problems with my family	○	○	○	○	○	○	○
I have friends with whom I can share my joys and sorrows	○	○	○	○	○	○	○
There is a special person in my life who cares about my feelings	○	○	○	○	○	○	○
My family is willing to help me make decisions	○	○	○	○	○	○	○
I can talk about my problems with my friends	○	○	○	○	○	○	○

Based on your best personal prediction, what will be your average grade this academic year?

- ☐ 70%+
- ☐ 60-69%
- ☐ 50-59%
- ☐ 40-49%
- ☐ 39% or below
- ☐ Doctoral student – Pass
- ☐ Doctoral student - Fail

Please rate the extent to which you agree or disagree with the following statements.

	Strongly Disagree				**Strongly Agree**
	1	2	3	4	5
If I have my own way, I will be studying at my university one year from now.	○	○	○	○	○
I frequently think about quitting my studies.	○	○	○	○	○
I am planning to search for a new course in the next 12 months.	○	○	○	○	○

Demographics

Thank you for completing the survey this far! You are almost done, please continue to the end of the survey!

What is your subject?

- [ ] Animation
- [ ] Art and Design
- [ ] Augmented and Virtual Realities
- [ ] Computer Science, AI and Robotics
- [ ] Drama, Performance and Theatre Studies
- [ ] Engineering
- [ ] English, Creative Writing and Philosophy
- [ ] Esports
- [ ] Fashion
- [ ] Film and Media
- [ ] Games Arts and Visual Effects
- [ ] Games Culture, PR and Management
- [ ] Games Design, Production and Programming
- [ ] Journalism and Content Creation
- [ ] Music and Sound
- [ ] Allied Health and Paramedic Science
- [ ] Nursing and Midwifery
- [ ] Social Work and Social Welfare
- [ ] Forensic Sciences and Policing
- [ ] International Studies and History
- [ ] Law
- [ ] Sociology, Criminology and Terrorism
- [ ] Biological and Biomedical Sciences
- [ ] Education
- [ ] Psychology and Counselling
- [ ] Sport and Exercise
- [ ] Accounting and Finance
- [ ] Business and Marketing
- [ ] Tourism and Event Management

What is your current year of study and of how many years predicted in your degree?
(For example: 2-nd year of 3 in this degree)

[ ] year of

[ ] in this degree

Level of Study

- [ ] Undergraduate
- [ ] Postgraduate
- [ ] Doctoral
- [ ] Postdoc

Are you taking your course in person or remotely?

- [ ] In person / on campus
- [ ] Remote / Distance learning
- [ ] Mixed - Both in person and remote

Are you a first-generation student?

- ☐ Yes
- ☐ No
- ☐ Prefer not to answer

Biological sex

- ☐ Female
- ☐ Male
- ☐ Prefer to specify myself
- ☐ Prefer not to answer

What is your gender identity?

- ☐ Woman
- ☐ Man
- ☐ Prefer to specify myself
- ☐ Prefer not to answer

What is your Nationality?

- ☐ Please specify
- ☐ Prefer not to answer

What is your racial or ethnic identity?

- ☐ Please specify
- ☐ Prefer not to answer

Are you a person living with a disability?

- ☐ Yes
- ☐ No
- ☐ Prefer not to answer

Is English your first language?

- [ ] Yes
- [ ] No / What is your first language?

Do you identify with a religion?

- [ ] No religion
- [ ] Yes - please specify

Answer as many as apply to you. **Are you currently (in):**

- [ ] Full-time education (university)
- [ ] Part-time education (university)
- [ ] Full-time work (employment, self-employment, placement, volunteering, etc.)
- [ ] Part-time work (employment, self-employment, placement, volunteering, etc.)
- [ ] Full-time care for another person
- [ ] Part-time care for another person
- [ ] Parent with a partner - sharing childcare
- [ ] Single parent
- [ ] Other major life occupation/responsibility (please specify)

Living circumstances

- [ ] Live at home
- [ ] Live in University accommodation
- [ ] Live in a privately rented accommodation
- [ ] Own my own home
- [ ] Other (please specify)

You have now been entered into the prize draw!

This will be held at the end of this wave of the study and if you are the winner, you will receive an email with your prize.

Good luck!

Thank you for taking part in this study!

The purpose of this study is to map out student wellbeing at key time points of the academic year. We will contact you either through your student email, tutors, or student support in 3 waves and ask you to complete the same measures. Please proceed to answer as true for you as possible on each wave of the study. By completing the 3 waves of the study and being honest you are helping us to expand the knowledge base of student wellbeing and to find impactful ways to benefit students in future years.

Your details will be kept confidential at all times, and complete anonymity will be maintained. Raw data will be kept in a locked cabinet and on a password-protected computer, which will only be accessible to me and my supervisor. Raw data will be destroyed after ten years. In the case of the data being used for academic publication, materials may be kept until ten years have passed from the date of publication.

For more detailed explanations, or if you wish to know the results of the study, please contact the researcher using the contact details below.

If you wish to withdraw your data you need to contact the researcher using the contact details below and quote your Student email and ID number, before the end of the academic year. No other information is required, and you will not be asked to provide a reason.

If you have been affected by some of the issues raised in this study and would like to talk to someone in confidence about it, you may wish to contact the following service(s) for support (the link below includes both internal and external support avenues): *https://www.staffs.ac.uk/students/support/student-wellbeing* You can get in touch by telephone on 01782 294976 or studentwellbeing@staffs.ac.uk.

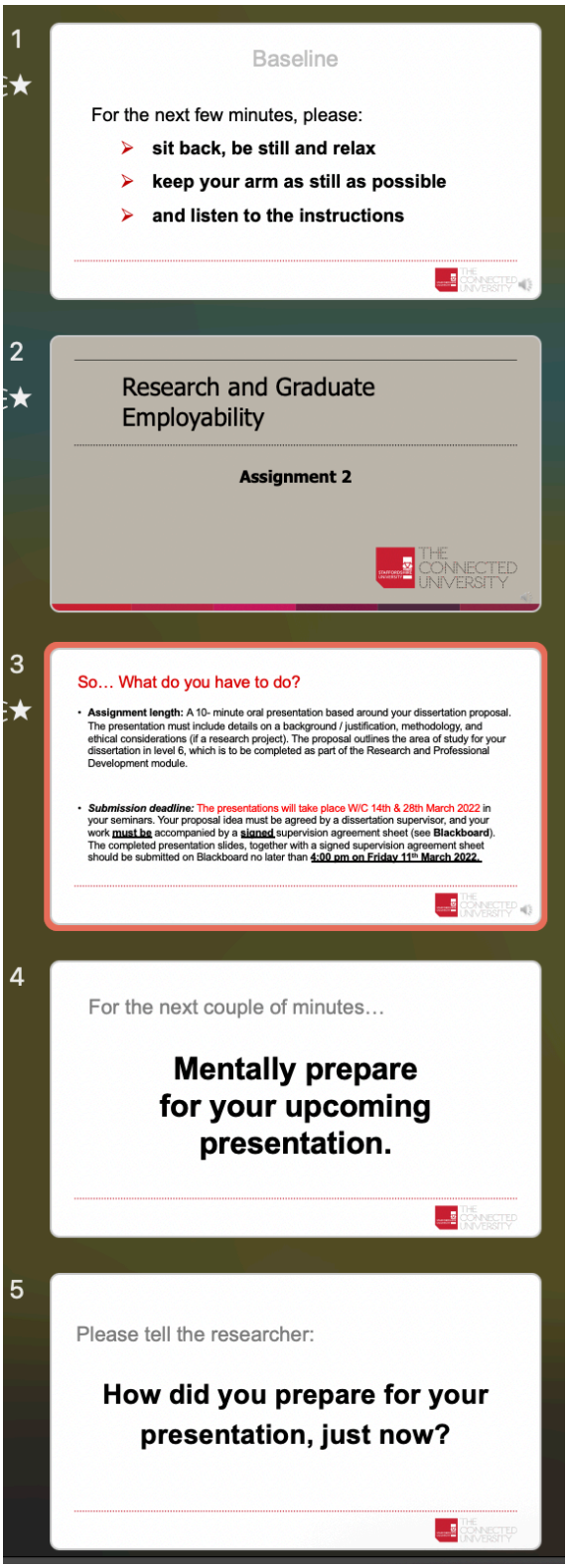
Thank you again for your participation!

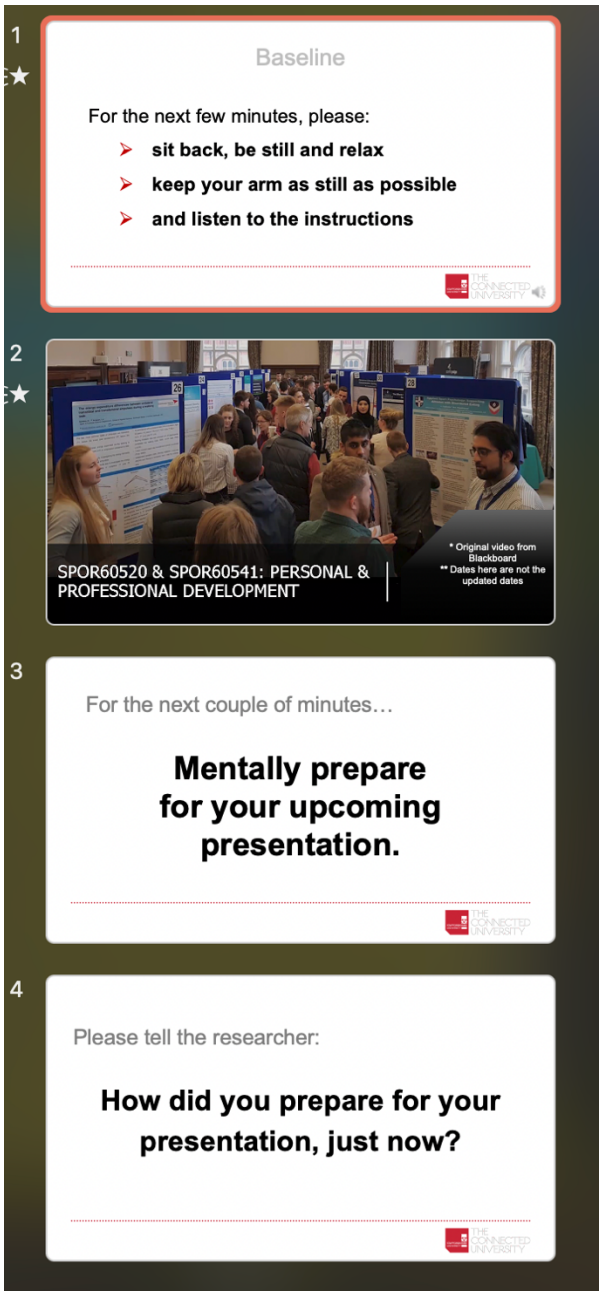
Researcher: Tsvetelina Nenkova
Email: t.nenkova@research.staffs.ac.uk

Supervisor: Matthew Slater
Email: M.Slater@staffs.ac.uk
Phone: 01782 294498

Appendix: Chapter 4

CVR lab presentation slides for the two cohorts (each includes assessment specific information from the cohort's course delivered by the voice of their tutor).





Participant Information Sheet

Study Title: The impact of psycho-social resources on challenge and threat states, wellbeing, and academic assessment performance in a cohort of university students: a field-based study.

Who is doing this research?

The research will be conducted by Tsvetelina Nenkova, a Sport, Exercise & Performance Psychology PhD researcher at Staffordshire University.

What is the research about?

I am conducting a study looking at stress & coping with academic assessments, and how they impact students' wellbeing and assessment performance.

Why am I being invited to participate?

You are a level 6 Staffordshire University student in the Deportment of Sport and Exercise.
You are Presenting a poster on your research project in the Viva day on the 26th May 2022 as part of your course.
Over the age of 18.

What is required of me?

I am asking you to take part in a 2-stage study lasting approximately 15 minutes per stage.

- **Stage 1:** you will…
  - … complete an online survey (15minutes)
- **Stage 2: On the day of your live presentation**, you will…
  - … complete a brief self-report survey (2minutes) and
  - … be connected to a cardiovascular recording machine while you listen to instructions about your upcoming presentation assessment (10minutes).
  - This stage should last around 15 minutes in total and
  - will take place immediately prior to your graded poster presentation.

Where will the study take place?

The study will take place at Staffordshire University, in an allocated research room. You will be completing the survey either electronically (via a Qualtrics survey web link), or on paper and hand back to the researcher directly. The researcher will connect you to a cardiovascular recording machine while you listen to instructions about your upcoming presentation assessment.

I know a friend who may be interested; can they participate in your study?

Yes, as long as your friend meets the criteria mentioned above. Your friend should contact the PhD researcher directly to discuss the study and make arrangements for them to take part. Contact details are given below.

What if I want to drop out?

If you wish to drop out at any stage during the study, then please just let the researcher know. If you wish to withdraw your data during or after the study you can do this, without any consequences, up to 7 days after the study has ended, by contacting the researcher (details below) and providing your student number and email (so that your data can be located and deleted).

Will the information I give you be kept confidential?

The information obtained will be treated with the strictest confidence throughout the study and the data will be stored safely in a secure location to which only the researcher has access.

Although you will be providing information about yourself, the information collected will be strictly confidential. You will be issued a participant number to maintain anonymity in subsequent analyses. Your student number/email, or any identifying information will not be included in any reports.

Note: your contact information (student number and email) will only be used for one of three reasons:
(1) to follow up with the next stages of the study.
(2) to help locate and delete your data should you request to withdraw.
and (3) to enter you into the prize draw and contact you should you win the prize draw.

What if I don't want to answer any questions?

If you do not wish to answer any of the questions that are included in the study, you are free to do so, without penalty.

What if I am upset by anything during the study?

If this happens, you might like to take a break, or if you prefer, you can decide to end your participation and withdraw from the study at that point. If you decide to withdraw, a copy of the debriefing sheet can be sent to you on request. Additionally, bellow are details where you can reach out for wellbeing and mental health support.

Who will have access to my data?

Only the PhD researcher and the researcher's supervisor will have access to the raw data.

Who will see the finished report?

All data in the finished report will be presented in the form of group statistics. The final report will be seen by the researcher's supervisor and assessors from the sport & exercise department, graduate school, and possibly by an external examiner. In addition, the completed PhD report may also be made available to future Staffordshire University students for teaching/reference/audit purposes and/or may feature in scientific journal publications.

What will happen to my responses to the study?

All data will be kept in secure storage (to which only the researcher has access) for up to ten years, according to departmental policy, and it will be destroyed after that.

Approval for this study and complaints procedure?

Approval for this study has been granted by Staffordshire University, Division of Psychology, Sport and Exercise, Ethics Committee.

Should you wish to raise a complaint/concern in relation to this study you can do so in confidence by getting in touch with the Director of Research Dr Tim Horne (Research, Innovation and Impact Services, Cadman Building, Staffordshire University, College Road Stoke-on Trent, ST4 2DF; Tim.horne@staffs.ac.uk and/or +441782295722)

GDPR Statement

Your data will be processed in accordance with the General Data Protection Regulation 2016 (GDPR).

The data controller for this project will be Staffordshire University. The university will process your personal data for the purpose of the research outlined above. The legal basis for processing your personal data for research purposes under the GDPR is a 'task in the public interest'. You can provide your consent for the use of your personal data in this study by completing the consent form that has been provided to you.

You have the right to access information held about you. Your right of access can be exercised in accordance with the GDPR. You also have other rights including rights of correction, erasure, objection, and data portability. Questions, comments, and requests about your personal data can also be sent to the Staffordshire University Data Protection Officer. If you wish to lodge a complaint with the Information Commissioner's Office, please visit www.ico.org.uk.

If you have been affected by some of the issues raised in this study, and would like to talk to someone in confidence about it, you may wish to contact the following service(s) for support (the link bellow includes both internal and external support avenues):
https://www.staffs.ac.uk/students/support/student-wellbeing You can get in touch by telephone on 01782 294976 or studentwellbeing@staffs.ac.uk.

Is there anyone I can talk to about the study before I take part?

If you wish to talk to someone else about this study before taking part, then please contact the PhD researcher or the project supervisor:

Supervisor contact details:
Name: Matthew Slater
Email: M.Slater@staffs.ac.uk
Phone: 01782 294498

If you have any further questions, please do not hesitate to contact me.

Researcher Contact Details:
Name: Tsvetelina Nenkova
Email address: T.Nenkova@research.staffs.ac.uk
Department of Sport and Exercise
Staffordshire University
ST4 2DF

Participant debrief sheet:

Thank you for taking part in this study!

The purpose of this study is to map out the impact of psycho-social resources on challenge & threat states, coping, wellbeing and academic performance. We will contact you through your student email with a brief follow up. Please proceed to answer as true for you as possible on each wave of the study. By completing the study and being honest you are helping us to expand the knowledge base of student wellbeing and achievement, and to find impactful ways to benefit students in future years.

Your details will always be kept confidential, and complete anonymity will be maintained. Raw data will be kept in a locked cabinet and on a password-protected computer, which will only be accessible to me, the researcher, and my supervisor. Raw data will be destroyed after ten years. In the case of the data being used for academic publication, materials may be kept until ten years have passed from the date of publication.

For more detailed explanations, or if you wish to know the results of the study, please contact the researcher using the contact details below.

If you wish to withdraw your data you need to contact the researcher using the contact details below and quote your Student email and ID number, before the end of the academic year. No other information is required, and you will not be asked to provide a reason.

If you have been affected by some of the issues raised in this study and would like to talk to someone in confidence about it, you may wish to contact the following service(s) for support (the link below includes both internal and external support avenues): *https://www.staffs.ac.uk/students/support/student-wellbeing* You can get in touch by telephone on 01782 294976 or studentwellbeing@staffs.ac.uk.

Thank you again for your participation!

Researcher: Tsvetelina Nenkova
Email: t.nenkova@research.staffs.ac.uk

Supervisor: Matthew Slater
Email: M.Slater@staffs.ac.uk
Phone: 01782 294498

Welcome!

On the following pages, you will have a chance to provide your *informed consent* to proceed with the study & an entry in the prize draw!

Project Title: **The BPS-W Project** (BioPsychoSocial - Wellbeing)

Study Title: **The impact of psycho-social resources on challenge and threat states, wellbeing and academic assessment performance in a cohort of university students: a field-based study.**

Please, contact the researcher with any questions or concerns.
Researcher Name: Tsvetelina Nenkova
Email: t.nenkova@research.staffs.ac.uk

Supervisor Name: Matthew Slater
Email: M.Slater@staffs.ac.uk

"I have read the Participant information sheet and wish to proceed with the study."

- ☐ Proceed
- ☐ Leave study

About you

Student Number (e.g., 10004652)	
Student email	
What is the name of your course?	
Your date of birth (e.g., 02/04/1992)	
How many siblings have you got?	

Participant Consent form

Please read the following items carefully and indicate (by ticking each box) that you have read, understood, and agreed with each item **and you give your informed consent to proceed**.

☐ I am over 18 years of age.

☐ I voluntarily agree to participate in a research project conducted and explained to me by the researcher, a Sport, Exercise & Performance Psychology PhD Researcher at Staffordshire University.

☐ I give my permission to the researcher to look up my assessment grades for the, for the purpose of this research.

☐ I have read the information sheet and understand that this research is being conducted as part of a PhD research project.

☐ I understand that I am being asked to participate in a study (2 stages lasting approximately 30minutes each) and involves me completing a survey and be connected to cardiovascular recording machine while I listen to instructions about an upcoming task.

☐ I understand that I am being asked to provide my student ID and email so that the researcher can follow up with me with regards to completing a follow up survey.

☐ I acknowledge that the task has been explained to me fully.

☐ I have been informed that I may withdraw from participating without penalty if I so wish and my data will be destroyed. I have been informed that withdrawal 7days after the end of the study will not be possible.

☐ The researcher has offered to answer any questions concerning the research and I have been provided with contact details for both the researcher and his/her supervisor.

☐ I understand I will be fully protected in accordance with the Data Protection Act of 2018, and in compliance with the British Psychological Society ethical guidelines, and that my data will be kept confidential and anonymous until they are securely destroyed.

☐ I understand that my name and any personal details will be anonymised in any report based on this study.

☐ I agree that any of the data I provide may be used in the researcher's report and possibly used for publication in academic journals.

☐ I understand that in case the data are used for publication, they will be kept until ten years after the article has been published, and then destroyed.

I give my informed consent to participate in this study.

**Note, you will automatically be entered into the prize draw once you complete the full study.*

☐ Yes (Proceed with study)

☐ No

Wellbeing

Below are some statements about feelings and thoughts. Please tick the box that best describes your experience of each **over the last 2 weeks.**

6	None of the time
7	Rarely
8	Some of the time
9	Often
10	All of the time

Over the last 2 weeks:	**1**	**2**	**3**	**4**	**5**
I've been thinking clearly	○	○	○	○	○
I've been feeling interested in other people	○	○	○	○	○
I've had energy to spare	○	○	○	○	○
I've been feeling confident	○	○	○	○	○
I've been interested in new things	○	○	○	○	○
I've been feeling loved	○	○	○	○	○
I've been feeling close to other people	○	○	○	○	○
I've been feeling optimistic about the future	○	○	○	○	○
I've been feeling good about myself	○	○	○	○	○
I've been dealing with problems well	○	○	○	○	○
I've been feeling useful	○	○	○	○	○
I've been feeling cheerful	○	○	○	○	○
I've been feeling relaxed	○	○	○	○	○
I've been able to make up my own mind about things	○	○	○	○	○

Emotions

Indicate the extent you have felt this way over **the past 2-3 days**.

	Strongly disagree				Strongly agree
Over the last 2-3 days I have felt …	**1**	**2**	**3**	**4**	**5**
Interested	○	○	○	○	○
Distressed	○	○	○	○	○
Excited	○	○	○	○	○
Upset	○	○	○	○	○
Strong	○	○	○	○	○
Guilty	○	○	○	○	○
Scared	○	○	○	○	○
Hostile	○	○	○	○	○
Enthusiastic	○	○	○	○	○
Proud	○	○	○	○	○
Irritable	○	○	○	○	○
Alert	○	○	○	○	○
Ashamed	○	○	○	○	○
Inspired	○	○	○	○	○
Nervous	○	○	○	○	○
Determined	○	○	○	○	○
Attentive	○	○	○	○	○
Jittery	○	○	○	○	○
Active	○	○	○	○	○
Afraid	○	○	○	○	○

Education

	From 0% important to 100% important										
	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
How important is this assessment for you?	○	○	○	○	○	○	○	○	○	○	○

	Not at all					Extremely
	1	2	3	4	5	6
How demanding do you expect this assessment to be?	○	○	○	○	○	○
How able are you to cope with the demands of this assessment?	○	○	○	○	○	○

	1 Not at all	2 A little	3 Moderately	4 Quite a bit	5 Completely
How important is it for you to perform well in this assessment?	○	○	○	○	○
To what extent do you feel confident that you can perform well on this assessment?	○	○	○	○	○
To what extent do you feel confident that you can fulfil your potential?	○	○	○	○	○

To what extent do you agree with the following statement:	Strongly disagree 1	2	3	4	Strongly agree 5
"The more effort I put into my assessment, the better I will do."	○	○	○	○	○

The following statements represent types of goals that you may or may not have regarding your assessment:

	Strongly disagree 1	2	3	4	5	6	Strongly agree 7
It is important to me to perform as well as I possibly can	○	○	○	○	○	○	○
I worry that I may not perform as well as I possibly can	○	○	○	○	○	○	○
It is important to me to do well compared to others	○	○	○	○	○	○	○
I just want to avoid performing worse than others	○	○	○	○	○	○	○

Appraisals

We are interested in how much **these statements apply to you**, in the context of **this assessment.**

	Strongly disagree					Strongly agree
	1	2	3	4	5	6
I tend to focus on the positive aspects of any situation	○	○	○	○	○	○
I worry that I will say or do the wrong things	○	○	○	○	○	○
I often think about what it would be like if I do very well	○	○	○	○	○	○
I believe that most stressful situations contain the potential for positive benefits	○	○	○	○	○	○
I worry about the kind of impression I make	○	○	○	○	○	○
I am concerned that others will find fault with me	○	○	○	○	○	○
Overall, I expect that I will achieve success rather than experience failure	○	○	○	○	○	○
In general, I look forward to the rewards and benefits of success	○	○	○	○	○	○
Sometimes I think that I am too concerned with what other people think of me	○	○	○	○	○	○
I feel that difficulties are piling up so that I cannot overcome them	○	○	○	○	○	○
I lack self-confidence	○	○	○	○	○	○
A challenging situation motivates me to increase my efforts	○	○	○	○	○	○
In general, I anticipate being successful at my chosen pursuits, rather than expecting to fail	○	○	○	○	○	○
I worry what other people will think of me even when I know that it doesn't make any difference	○	○	○	○	○	○
I am concerned that others will not approve of me	○	○	○	○	○	○
I look forward to opportunities to fully test the limits of my skills and abilities	○	○	○	○	○	○
I worry about what other people may be thinking about me	○	○	○	○	○	○
I feel like a failure	○	○	○	○	○	○

Beliefs

Here are a set of statements that describe what some people think and believe. Read carefully and indicate how much you agree or disagree with each statement.

	Strongly disagree 1	2	3	4	Strongly agree 5
I have to be viewed favourably by people that matter to me	○	○	○	○	○
I need others to think that I make a valuable contribution	○	○	○	○	○
I absolutely should not be snubbed by people that matter to me	○	○	○	○	○
I must not be dismissed by my peers	○	○	○	○	○
I have to be respected by my peers	○	○	○	○	○
I can't stand not reaching my goals	○	○	○	○	○
I can't bear not succeeding in things that are important to me	○	○	○	○	○
I can't stand failing in things that are important to me	○	○	○	○	○
I can't bear not getting better at what I do	○	○	○	○	○
I couldn't stand it if my competencies did not continually develop and improve	○	○	○	○	○
It's awful if others think I do not make a valuable contribution	○	○	○	○	○
It would be terrible to be dismissed by my peers	○	○	○	○	○
It is appalling if others do not give me chances	○	○	○	○	○
It would be awful if my position on my course was not secure	○	○	○	○	○
It's terrible if my peers do not respect me	○	○	○	○	○
If others think I am no good at what I do, it shows I am worthless	○	○	○	○	○
If I face setbacks it goes to show how stupid I am	○	○	○	○	○
I am a loser if I do not succeed in things that matter to me	○	○	○	○	○
If my position on my course was not secure, then it would show I am worthless	○	○	○	○	○
If my competencies did not continually develop and improve, it would show what a failure I am	○	○	○	○	○

Social Support

Below is a list of items referring to the types of help and support you may have available to you as a student. **Please indicate to what extent you have these types of support available to you.**

If needed, to what extent would someone . . .	Not at all 1	Slightly 2	Moderately 3	Considerably 4	Extremely 5
… provide you with comfort and security	○	○	○	○	○
… reinforce the positives of a situation	○	○	○	○	○
... help with travel to lectures/seminars or exams	○	○	○	○	○
... enhance your self-esteem	○	○	○	○	○
... give you constructive criticism	○	○	○	○	○
... help with tasks to leave you free to concentrate	○	○	○	○	○
... give you specific advice	○	○	○	○	○
... always be there for you	○	○	○	○	○
... instil you with the confidence to deal with pressure	○	○	○	○	○
... do things for you at competitions/matches	○	○	○	○	○
... care for you	○	○	○	○	○
... boost your sense of competence	○	○	○	○	○
... give you advice about performing in your studies	○	○	○	○	○
... show concern for you	○	○	○	○	○
... give you advice when you're performing poorly	○	○	○	○	○
... help you organise and plan your studies/assessments	○	○	○	○	○

Identity

We are interested in how much you identify with being a Staffordshire University student.

	Strongly disagree 1	2	3	4	5	6	Strongly agree 7
I identify as a Staffordshire university student	○	○	○	○	○	○	○
I feel committed to Staffordshire university and my course	○	○	○	○	○	○	○
I am glad to be a Staffordshire university student	○	○	○	○	○	○	○
Being a Staffordshire University student is an important part of how I see myself	○	○	○	○	○	○	○

Based on your best personal prediction, what will be your grade on this assessment?

- ☐ 70%+
- ☐ 60-69%
- ☐ 50-59%
- ☐ 40-49%
- ☐ 39% or below

Demographics

Thank you for completing the survey this far! You are almost done, please continue to the end of the survey!

What is your subject?

- ☐ Animation
- ☐ Art and Design
- ☐ Augmented and Virtual Realities
- ☐ Computer Science, AI, and Robotics
- ☐ Drama, Performance and Theatre Studies
- ☐ Engineering
- ☐ English, Creative Writing and Philosophy
- ☐ Esports
- ☐ Fashion
- ☐ Film and Media
- ☐ Games Arts and Visual Effects
- ☐ Games Culture, PR, and Management
- ☐ Games Design, Production and Programming
- ☐ Journalism and Content Creation
- ☐ Music and Sound
- ☐ Allied Health and Paramedic Science
- ☐ Nursing and Midwifery
- ☐ Social Work and Social Welfare
- ☐ Forensic Sciences and Policing
- ☐ International Studies and History
- ☐ Law
- ☐ Sociology, Criminology and Terrorism
- ☐ Biological and Biomedical Sciences
- ☐ Education
- ☐ Psychology and Counselling
- ☐ Sport and Exercise
- ☐ Accounting and Finance
- ☐ Business and Marketing
- ☐ Tourism and Event Management

What is your current year of study and of how many years predicted in your degree?
(For example: 2-nd year of 3 in this degree)

- ☐ year of
- ☐ in this degree

Level of Study

- ☐ Undergraduate
- ☐ Postgraduate
- ☐ Doctoral
- ☐ Postdoc

Are you taking your course in person or remotely?

- ☐ In person / on campus
- ☐ Remote / Distance learning
- ☐ Mixed - Both in person and remote

Are you a first-generation student?

- [ ] Yes
- [ ] No
- [ ] Prefer not to answer

Biological sex

- [ ] Female
- [ ] Male
- [ ] Prefer to specify myself
- [ ] Prefer not to answer

What is your gender identity?

- [ ] Woman
- [ ] Man
- [ ] Prefer to specify myself
- [ ] Prefer not to answer

What is your Nationality?

- [ ] Please specify
- [ ] Prefer not to answer

What is your racial or ethnic identity?

- [ ] Please specify
- [ ] Prefer not to answer

Are you a person living with a disability?

- [ ] Yes
- [ ] No
- [ ] Prefer not to answer

Is English your first language?

- [ ] Yes
- [ ] No / What is your first language?

Do you identify with a religion?

- [ ] No religion
- [ ] Yes - please specify

Answer as many as apply to you. **Are you currently (in):**

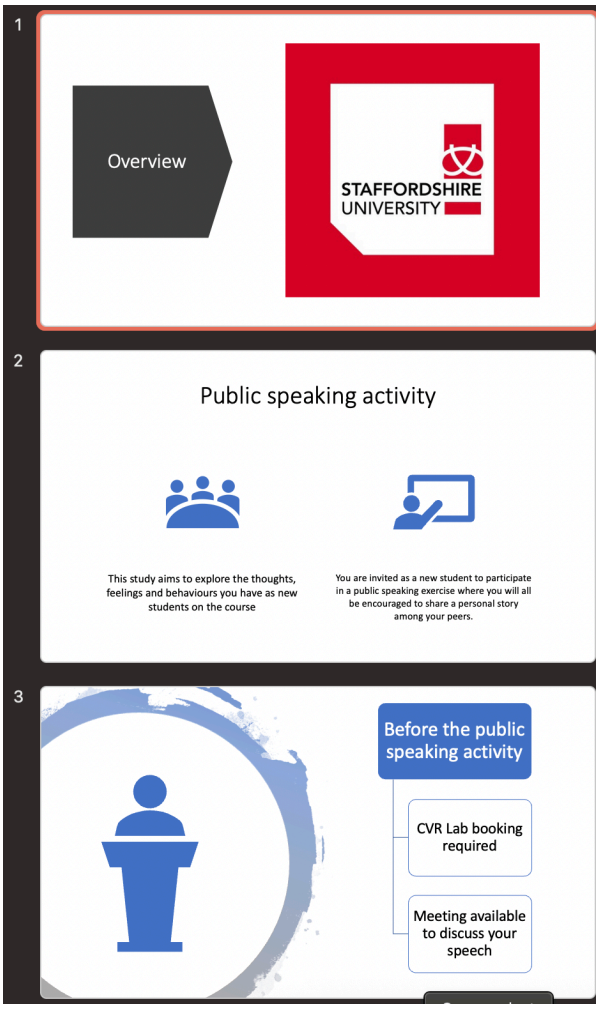
- [ ] Full-time education (university)
- [ ] Part-time education (university)
- [ ] Full-time work (employment, self-employment, placement, volunteering, etc.)
- [ ] Part-time work (employment, self-employment, placement, volunteering, etc.)
- [ ] Full-time care for another person
- [ ] Part-time care for another person
- [ ] Parent with a partner - sharing childcare
- [ ] Single parent
- [ ] Other major life occupation/responsibility (please specify)

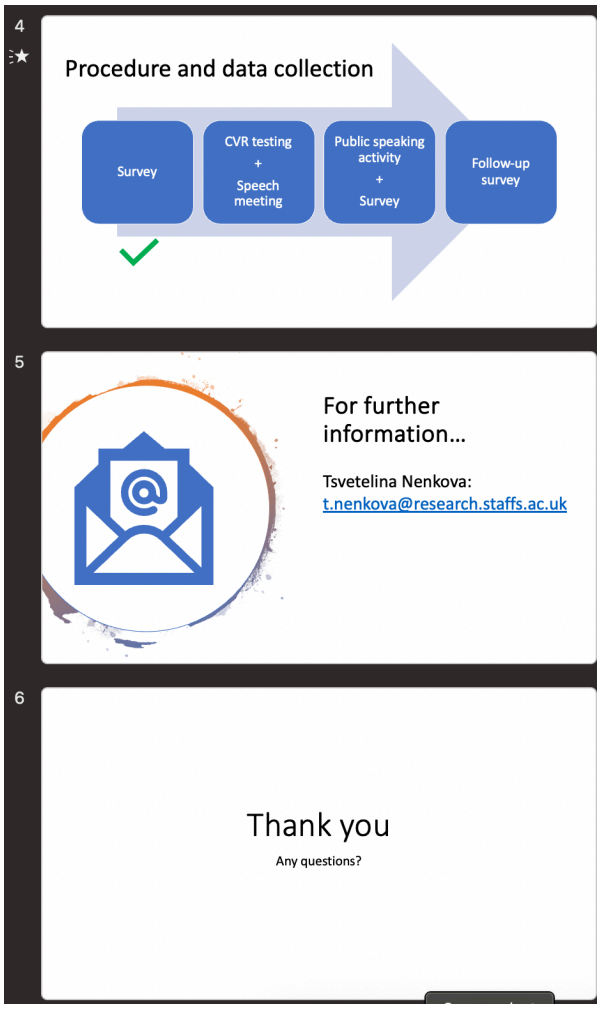
Living circumstances

- [ ] Live at home
- [ ] Live in University accommodation
- [ ] Live in a privately rented accommodation
- [ ] Own my own home
- [ ] Other (please specify)

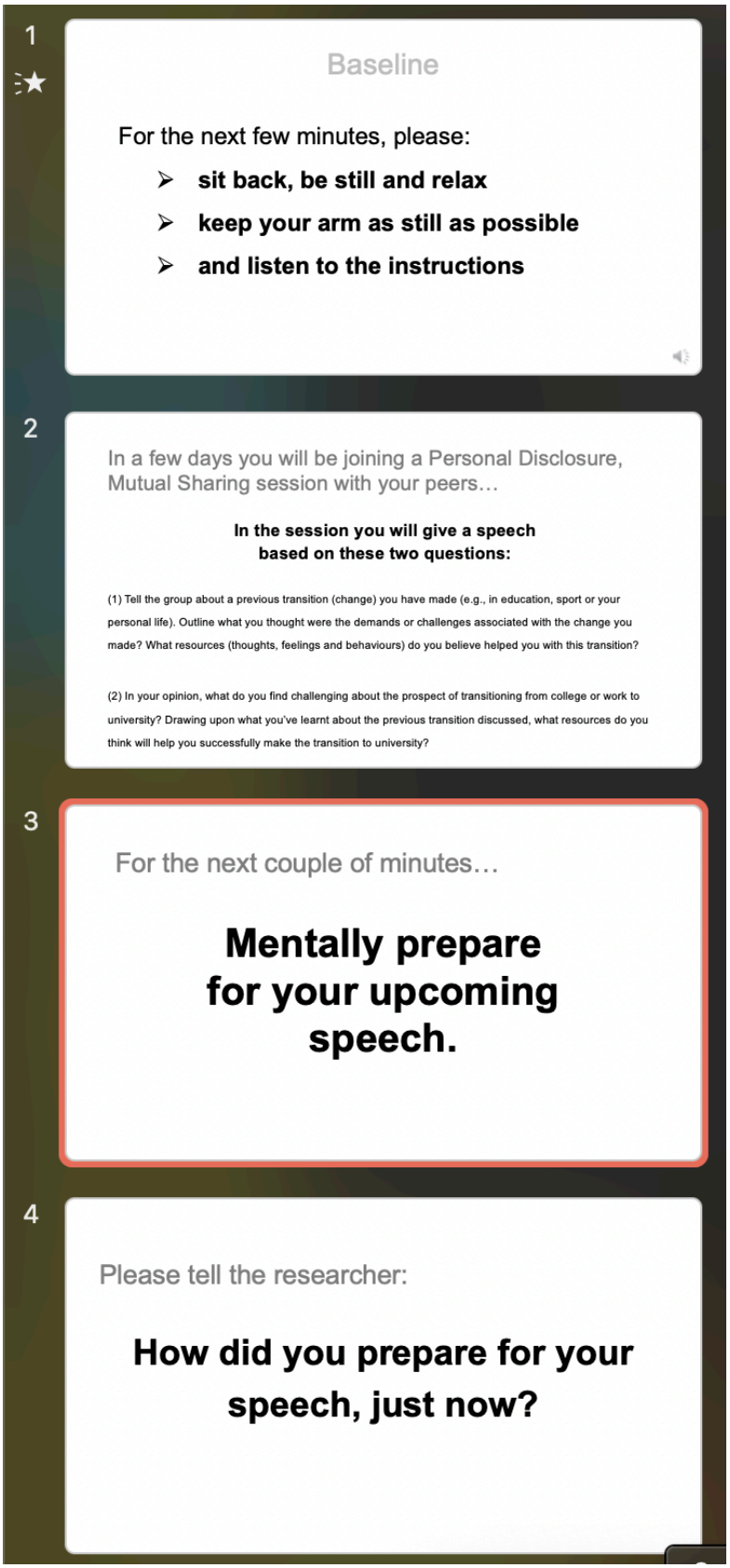
Appendix: Chapter 5

COPDMS intervention group introduction to the study

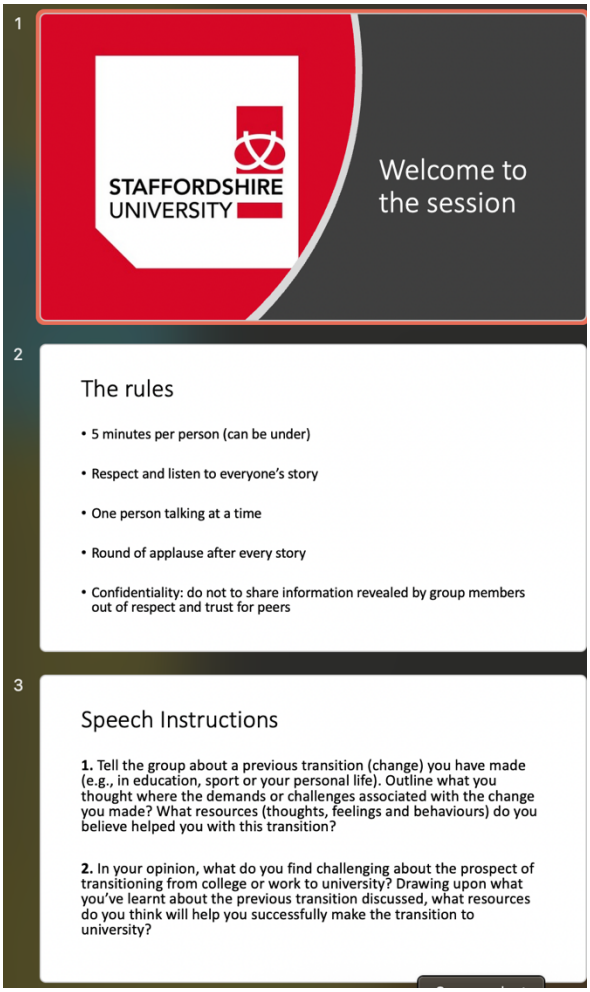


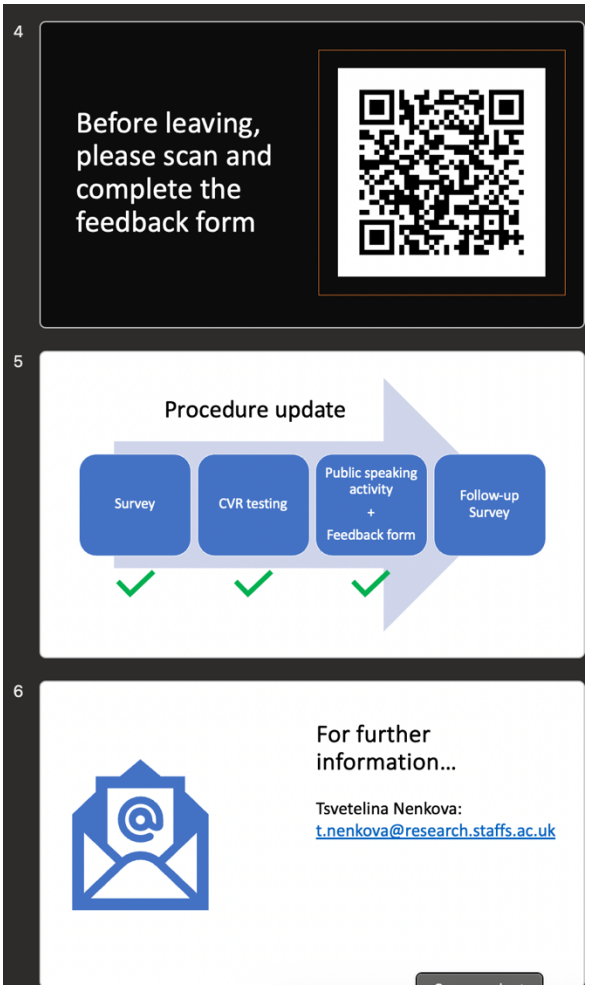


Cardiovascular challenge and threat data collection lab instructions



COPDMS session delivery instructions





Research participant information sheet

Dear student,

You are invited to take part in an exciting project focussed on your wellbeing and academic achievement, the BioPsychoSocial Student Wellbeing (BPS-w) project. The current study will run in relation to your transition into the present academic year, and for your participation you will be entered into a ***prize draw for a £50 Amazon gift card***!

What will this involve?

You will need to complete all study phases in order to be entered into the prize draw:

Phase 1*: complete a survey (15minutes), listen to the briefing (15minutes) and put your name down for a lab slot (30sec).*

Phase 2 *(20minues): Come in for your lab slot. Here you will be connected to a cardiovascular measuring machine (non-invasive) and watch a 10minute video presentation.*

Phase 3 *(60minutes): Take part in a sharing session and complete the session feedback survey.*

Follow up phase *(15 minutes): complete an online follow up survey in a months' time (note, you will receive a reminder for this).*

Will my participation impact my studies or grades?

Your information will be used for research purposes only. Your data will be fully anonymised, and the results of the research will not impact your grades. Your decision to participate will not have any bearing on assessments in the module or the outcomes of the course.

How do you take part?

Read the Participant information sheet, sign the Consent form, complete your survey now and the remaining phases of the study.

Any questions/concerns?

Please speak to the researcher/facilitator.

Alternatively, you can contact the researcher on: t.nenkova@research.staffs.ac.uk

Thank you!

Participant information sheet

Study Title: The BPS-W project: a Biopsychosocial examination of Student Wellbeing.

Who is doing this research?

The research will be conducted by Tsvetelina Nenkova, Sport and Exercise Psychology PhD researcher at Staffordshire university; Harry Warburton, Lecturer in Sports, Coaching & Development, University of the West of Scotland; Dr Mathew Slater, Associate Professor of Sport and Exercise Psychology, Staffordshire university; Dr Jamie Gillman, Lecturer in Psychology, University of Salford.

What is the research about?

I am conducting a study looking at stress & coping with transitioning into academic studies, and how they impact students' wellbeing and achievement.

Why am I being invited to participate?

- You are a university student.
- Over the age of 18.

What is required of me?

To take part in all study phases:

Phase 1*: complete a survey now(15minutes), listen to the briefing (15minutes) and put your name down for a lab slot (30sec).*

Phase 2 *(20minues): Come in for your lab slot. Here you will be connected to a cardiovascular measuring machine (non-invasive) and watch a 10minute video presentation.*

Phase 3 *(60minutes): Take part in a sharing session (description below) and complete the session feedback survey.*

Follow up phase *(15 minutes): complete an online follow up survey in a months' time (note, you will receive a reminder for this).*

To provide your contact details and student number (so that I can follow up with you with a lab slot reminder, the follow up survey, and the amazon gift card prize draw).

What is a sharing session?

For the sharing session, you will be asked to prepare a short 5 minute personal story that you are willing to share with your peer group. The theme of the stories will draw upon your experience of coping with a challenging transition (e.g. from education, life, or sport). In order to get the most out of the session we advise that you prepare your speech in advance. Support will be given to you in preparation of your speech during the CVR measurement lab.

What are the potential benefits or disadvantages of participation?

Participation may allow you to get to know your peers and may therefore benefit your university experience. We recognise that speaking in front of your peers can be daunting and personal stories shared may be emotional in nature. Nevertheless, as a student, this activity provides you with an opportunity to improve your public speaking skills and connect with your peers. During the session, we ask that you are respectful of your peers' participation and listen to their speech without interrupting. In order to maintain a level of confidentiality and psychological safety we ask that you not share their stories with anyone else.

Where will the study take place?

The study will take place on the university campus, in an allocated research room. You will be completing the survey either electronically (via a Qualtrics survey web link), or on paper and hand back to the researcher directly. For phase 2 the researcher will connect you to a cardiovascular recording machine while you listen to instructions about the sharing session.

What if I want to drop out?

If you wish to drop out at any stage during the study, then please just let the researcher know. If you wish to withdraw your data during or after the study you can do this, without any consequences, up to 7 days after the study has ended, by contacting the researcher (details below) and providing your student email (so that your data can be located and deleted).

Will the information I give you be kept confidential?

The information obtained will be treated with the strictest confidence throughout the study and the data will be stored safely in a secure location to which only the researcher has access.

Although you will be providing information about yourself, the information collected will be strictly confidential. You will be issued a participant number to maintain anonymity in subsequent analyses. Your student number/email, or any identifying information will not be included in any reports.

Note: your contact information will only be used for one of these reasons:

(1) to send you a confirmation and reminder for your lab slot

(2) to follow up with the next phases of the study.

(3) to help locate and delete your data should you request to withdraw.

and (4) to enter you into the prize draw and contact you with the outcome.

Note, all information shared will remain confidential, with the following exceptions:

1) If it is believed that you or another person is at risk of imminent or anticipated harm that can only be prevented through disclosing information.

2)Where there is legal obligation to do so (i.e., information shared involves breaking the law).

What if I don't want to answer any questions?

If you do not wish to answer any of the questions that are included in the study, you are free to do so, without penalty.

What if I am upset by anything during the study?

Stories shared during the sharing session may be distressing in nature. If this happens, you might like to take a break, or if you prefer, you can decide to end your participation and withdraw from the study at that point. If you decide to withdraw, a copy of the debriefing sheet will be sent to you on request. Additionally, bellow are details where you can reach out for wellbeing and mental health support.

Who will have access to my data?

Only the PhD researcher and the researcher's supervisor will have access to the raw data.

Who will see the finished report?

All data in the finished report will be presented in the form of group statistics. The final report will be seen by the researcher's supervisor and assessors from the sport & exercise department, graduate school, and possibly by an external examiner. In addition, the completed PhD report may also be made available to future Staffordshire University students for teaching/reference/audit purposes and/or may feature in scientific journal publications.

What will happen to my responses to the study?

All data will be kept in secure storage (to which only the researcher has access) for up to ten years, according to departmental policy, and it will be destroyed after that.

Approval for this study and complaints procedure?

Approval for this study has been granted by Staffordshire University, Division of Psychology, Sport and Exercise, Ethics Committee.

Should you wish to raise a complaint/concern in relation to this study you can do so in confidence by getting in touch with the Director of Research Dr Tim Horne (Research, Innovation and Impact Services, Cadman Building, Staffordshire University, College Road Stoke-on Trent, ST4 2DF; Tim.horne@staffs.ac.uk and/or +441782295722)

GDPR Statement

Your data will be processed in accordance with the General Data Protection Regulation 2016 (GDPR).

The data controller for this project will be Staffordshire University. The university will process your personal data for the purpose of the research outlined above. The legal basis for processing your personal data for research purposes under the GDPR is a 'task in the public interest'. You can provide your consent for the use of your personal data in this study by completing the consent form that has been provided to you.

You have the right to access information held about you. Your right of access can be exercised in accordance with the GDPR. You also have other rights including rights of correction, erasure, objection, and data portability. Questions, comments, and requests about your personal data can also be sent to the Staffordshire University Data Protection Officer. If you wish to lodge a complaint with the Information Commissioner's Office, please visit www.ico.org.uk.

If you have been affected by some of the issues raised in this study, and would like to talk to someone in confidence about it, you may wish to contact the following service(s) for support (the link bellow includes both internal and external support avenues):

Staffordshire University students: https://www.staffs.ac.uk/students/support OR you can get in touch by telephone on 01782 294976 or studentwellbeing@staffs.ac.uk.

Is there anyone I can talk to about the study before I take part?

If you wish to talk to someone else about this study before taking part, then please contact the PhD researcher or the project supervisor:

Supervisor contact details:

Name: Matthew Slater Email: M.Slater@staffs.ac.uk Phone: 01782 294498

If you have any further questions, please do not hesitate to contact me.

Researcher Contact Details:

Name: Tsvetelina Nenkova

Email address: T.Nenkova@research.staffs.ac.uk

Department of Sport and Exercise

Staffordshire University

ST4 2DF

Appendix: Conference presentation slides (Chapter 3)

The influence of social identity & support on sport and exercise students' affect, cardiovascular reactivity, and performance in an assessed presentation

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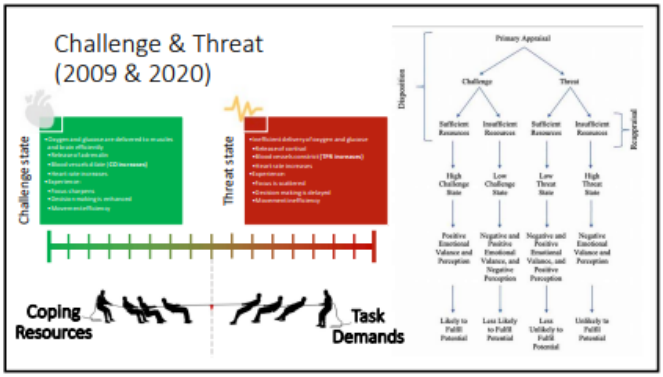
1

Challenge & Threat (2009 & 2020)



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3

The study

Design: Field-based

Aim: Capture responses and resource evaluations, immediately prior to a performance (assessed presentation).

Test:

- The acute impact of demand – resource appraisals on cardiovascular reactivity and assessment outcomes.
- The fit of SI and perceived SS, in the TCTSA-R

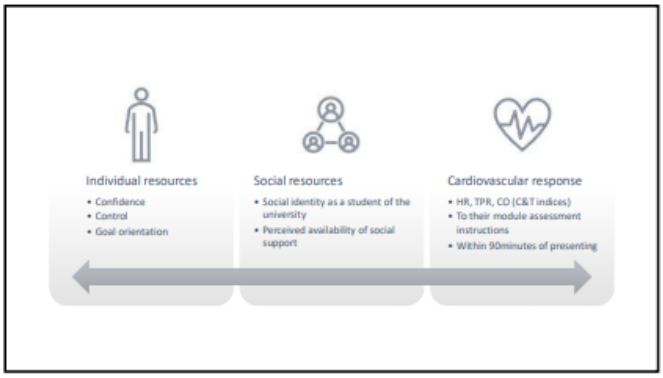
4

Sport and Exercise students

2 cohorts:
24 second year UG
14 final year UG

Delivering an assessed live presentation as part of their BSc programme

5



6


Field based lab set up
Baseline
4.5min mindfulness script
Research and Graduate Employability
Instructions cohort 1
2.2min video instructions on the assessment
Mentally prepare for your upcoming presentation.
Task:
"Mentally prepare for your presentation."
How did you prepare for your presentation, just now?
Coping question and manipulation check

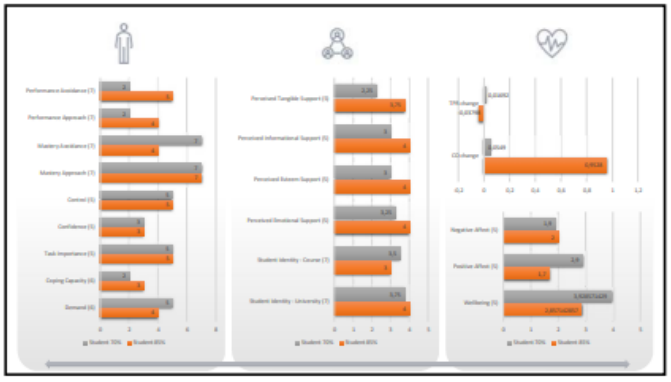
7


Field based lab set up
Baseline
4.5min mindfulness script
Instructions cohort 2
2.5min video instructions on the assessment
Mentally prepare for your upcoming presentation.
Task:
"Mentally prepare for your presentation."
How did you prepare for your presentation, just now?
Coping question and manipulation check

8


Preliminary case comparison:

9



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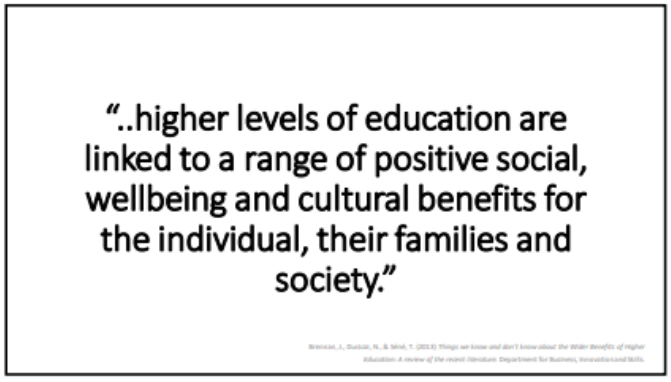
"..higher levels of education are linked to a range of positive social, wellbeing and cultural benefits for the individual, their families and society."

11


Thank you!

12