An fsQCA Approach to Exploring Student Personality Profiles Associated with Techno-Eustress in Online Learning

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ABSTRACT

The COVID-19 pandemic's shift to digital education intensified student technostress in emerging digital education landscapes like Malaysia and impeded engagement. Recent research highlights techno-eustress, positive responses to technological challenges, as a predictor of improved online learning performance. This study examines how the configuration of broad personality traits and IT mindfulness enable students to perceive technological demands as stimulating rather than overwhelming. Integrating the Transactional Model of Stress and Coping, Five-Factor Model, and Mindfulness-to-Meaning Theory, we surveyed a purposive sample of 79 high-achieving students at a private university in Malaysia. Using fuzzy-set Qualitative Comparative Analysis (fsQCA), a configurational approach that identifies multiple combinations of conditions leading to the same outcome, we identified four distinct personality profiles associated with techno-eustress. IT mindfulness consistently appeared as a highly consistent necessary condition across the identified configurations, suggesting that it plays a foundational enabling role in the positive reappraisal of technological demands. The findings advance techno-eustress theory by showing that personality configurations shape coping effectiveness and adaptive outcomes. Practically, the results offer contextual insights for educators and institutions designing targeted interventions for similar high-achieving student cohorts, empowering them to transform technostress into productive engagement in online learning environments.

Keywords: Personality profiles; techno-eustress; personality traits; IT mindfulness; online learning

Introduction

While the rapid transition to online education highlighted global vulnerabilities in digital learning (O'Hagan, 2020; Ul Hassan et al., 2025; Jaafar et al., 2022), it was particularly disruptive in emerging educational landscapes like Malaysia. Despite robust digital infrastructure (Malaysian Investment Development Authority, 2021), over 85% of Malaysian tertiary students reported emotional distress and technical barriers during the transition,

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underscoring the urgent need to understand student coping mechanisms under digital pressure (Devi, 2022; Menon, 2021; Tariq, 2022). This sudden change, coupled with the pressure to ensure continuity of education, highlighted important gaps in our understanding of how students respond to intensive technology use. The psycho-social stressors that arose included digital fatigue, anxiety, and decreased engagement (García-Morales et al., 2021; Watermeyer et al., 2021). The resulting technostress, or psychological stress caused by insufficient coping with technological-related pressures (Ragu-Nathan et al., 2008), became a prominent problem in the digital learning environment.

Beyond Technostress: The Promise of Techno-Eustress

Traditional studies have focused on the harmful effect of technology-related stress (Tarafdar et al., 2017). Recent evidence, however, brings out the new phenomenon of techno-eustress - a normative form of stress in which technological demands are experienced in the form of challenges rather than threats (Nascimento et al., 2024; Shirish et al., 2023). Students who redefine technological challenges as opportunities for growth show increased engagement, resilience, and academic performance (Sun et al., 2023).

The Role of Personality in Technology Adaptation

Variations in student responses also require consideration of individual differences in perception and stress management (Ayyagari et al., 2011). Although the Five-Factor Model (Costa & McCrae, 1998) offers some useful insights, personality traits do not work in isolation. Consequently, it is imperative to examine how specific trait constellations affect adaptation to learning scenarios that rely heavily on technology (Grant & Langan-Fox, 2006).

Research Gaps and oOpportunities

While the significance of individual differences in technology acceptance has been recognized, there are still large gaps in terms of the role of students' personality traits in making them vulnerable to techno- eustress. Existing research mainly focuses on broad personality traits or context-specific traits individually and therefore overlooks interactional effects of personality organization levels that may produce adaptive outcomes (Maier et al., 2019; Postigo et al., 2021).

Furthermore, most technostress research is based in Western contexts, so little is known about its cross-cultural applicability. Previous studies by Pflügner et al. (2021) have found personality profiles that predispose individuals to experience technostress, but positive adaptation profiles remain unexplored. Consequently, this study addresses the need for research in non-Western educational technology (Nascimento et al., 2024) and explores the nexus between personality traits and techno-eustress.

While prior research often isolates individual personality traits when examining technostress and technology use, these traits in reality act together and interdependently to influence individual perceptions (Grant & Langan-Fox, 2006; Pflügner et al., 2021). For instance, a student high in neuroticism may respond very differently to digital pressure depending on whether conscientiousness or agreeableness is also present. The same trait that is a vulnerability in one combination may serve as a resource in another. The negative impact of a single personality flaw can be offset by the overall combination of a person's other traits (Vollrath & Torgersen, 2000). While the literature shows that individual personality traits influence technostress perceptions (Maier et al., 2019) and interact with one another (Pflügner et al., 2021), research remains limited on the holistic personality profiles that enable users to perceive technological demands positively as techno-eustress. A configurational perspective therefore offers a more realistic understanding of how different combinations of personality

characteristics jointly contribute to techno-eustress. This approach aligns with the principle of equifinality, whereby multiple pathways can lead to the same adaptive outcome.

Research Objective and Question

The current study seeks to describe how certain sets of personality traits (broad and narrow) support students' perceptions of technological demands as techno-eustress in online learning environments. Accordingly, the research questions are as follows:

RQ1: What are the personality profiles of the students?

RQ2: To what extent do they empower students to view IT demands as techno-eustress?

Addressing these questions is crucial because they illuminate why some students thrive under digital pressure while others disengage, and how mindful technology engagement enables positive adaptation regardless of broader personality differences. To answer the research questions, we use fuzzy-set Qualitative Comparative Analysis (fsQCA), a configurational approach that combines qualitative and quantitative logic. fsQCA identifies bundles of conditions (personality traits) that lead to an outcome (techno-eustress) and captures non-linearities between psychological variables that traditional regression models may miss (Fiss, 2011; Ragin, 2008).

This study draws on three complementary theoretical frameworks. The Transactional Model of Stress and Coping (Lazarus & Folkman, 1984) explains how individuals appraise and respond to stressors. The theory distinguishes, crucially, between threat appraisals that produce distress and challenge appraisals that generate motivational energy. The Five-Factor Model (Costa & McCrae, 1998) provides a well-validated taxonomy of broad personality traits, comprising openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. The Mindfulness-to-Meaning Theory (Garland et al., 2015) explains how mindful attention redirects cognition from automatic negative interpretations toward reappraisal and the construction of positive meaning. Integrating these three frameworks within a configurational logic allows the study to move beyond single-trait or single-mechanism explanations, examining how particular combinations of personality characteristics enable students to transform IT-related pressure into a productive and motivating experience.

Literature Review

Background Studies

Empirical research shows that technology-intensive learning environments significantly affect students' stress and academic behavior. Technostress is associated with decreased behavioral intention towards online learning (Awang Kader et al., 2022) and diminished learning quality, though institutional support moderates these effects (Saleem et al., 2024). Cross-cultural studies indicate that online hours, high technology complexity, and low self-efficacy increase technostress (Cazan et al., 2024). On the other hand, techno-eustress, a constructive reaction by individuals to the demands of technology, develops over time and is influenced by IT mindfulness and coping flexibility (Nascimento et al., 2025). Most importantly, Pflügner et al. (2021) identified six personality profiles that predispose users to high levels of technostress, suggesting that different trait levels shape how users perceive technostress.

These findings point to three themes: (1) technostress is present throughout digital learning; (2) personality, coping mechanisms, and exposure to technology are critical; (3) techno-eustress shows that technology-related stress can be beneficial. Nonetheless, most research examines personality traits or contextual supports in isolation and fails to account for how trait combinations promote positive stress in digital learning.

Understanding Personality: From Traits to Profiles

Personality research has moved from early theories of personality traits, which focused on defining and quantifying personality characteristics, to contemporary multivariate approaches that acknowledge complex personality structures (Kropotov, 2016) (see Figure 1).

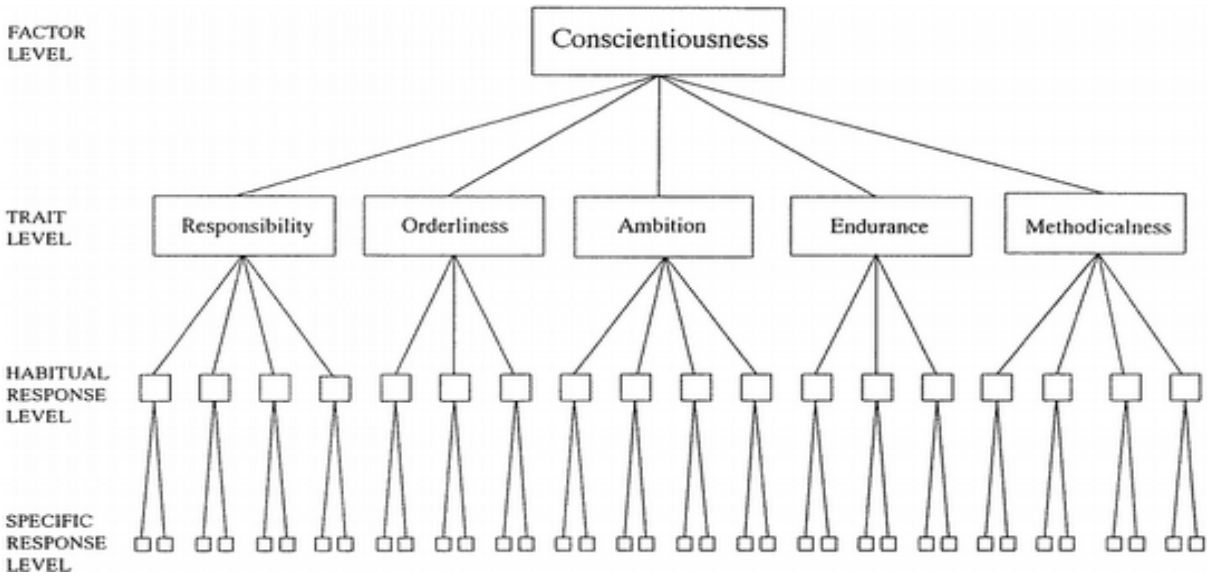
At the top of this hierarchy are broad traits, that is, relatively stable, cross-situational inclinations that affect behavior across situations, such as, for example, the Five-Factor Model (FFM): openness, conscientiousness, extraversion, agreeableness and neuroticism (McCrae & Costa Jr., 1997). While traits like openness and conscientiousness typically facilitate online self-regulation and digital tool adoption (Audet et al., 2021; Bhagat et al., 2019), extraversion and agreeableness may manifest differently when face-to-face peer interaction is reduced (Baruth & Cohen, 2023; Costa & McCrae, 1998), and high neuroticism typically increases overall stress susceptibility (Vollrath & Torgersen, 2000). However, these traits do not act in isolation.

Narrow traits are linked to lower levels of specific habits or behavior (Paunonen, 1998). For example, IT mindfulness has been identified as an important narrow trait that facilitates students' ability to perceive stress positively in the online learning context (Shirish et al., 2021). IT mindfulness includes four dimensions that directly indicate adaptive system use and decision-making: alertness to distinctions, awareness of multiple perspectives, openness to novelty, and present-orientation (Thatcher et al., 2018). Students who use technology mindfully are more likely to show increased creativity in using technological tools, have more skills to overcome technical problems, and better recognise opportunities to enhance learning with technology rather than replace traditional practices (Wei et al., 2021).

It remains a matter of intellectual debate whether broad or narrow traits better predict behaviour. Some research shows that narrow traits have better predictive validity for specific outcomes (Maier et al., 2019). In light of these views, the present paper combines the broad traits of the Big Five with the narrow trait of IT mindfulness to investigate learners' perceptions of information technology challenges.

Figure 1.

The Hierarchical Model of Personality Organisation (Paunonen, 1998)



Technostress and Techno-Eustress: Reframing Technology-Related Stress

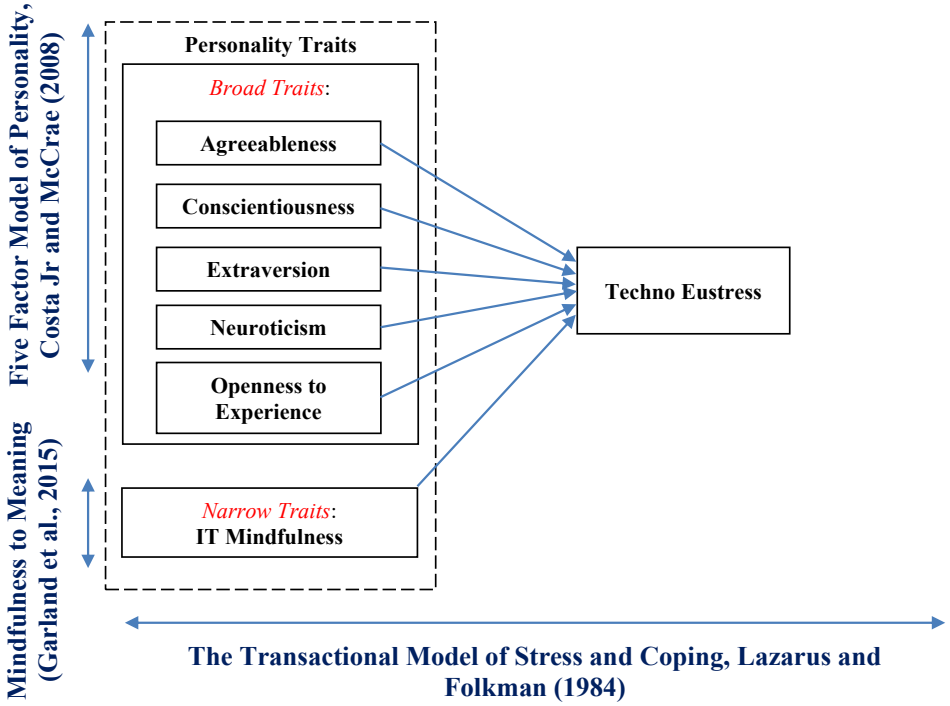
Technostress is manifested in anxiety, exhaustion, and perceived ineffectiveness due to information and communications technology (ICT) distress (Brod, 1984). Conversely, techno-eustress reinterprets technology-based stress as a challenge appraisal, which makes performance more energetic, exciting, and motivating (Nascimento et al., 2024; Tarafdar et al., 2014). The transactional model of stress and coping (TSC) (Lazarus & Folkman, 1984) helps explain differential responses in both appraisal and coping. Techno-eustress is driven by three processes: cognitive reappraisal (interpreting problems as opportunities), problem-focused coping (activation of technical solutions) (Sharma & Gupta, 2022), and meaning-making (matching challenges with goals) (Shirish et al., 2021). These mechanisms resemble the Mindfulness-to-Meaning Theory (MMT), in which mindful attention leads to reappraisal and meaning creation that can turn adversity into developmental progress (Garland et al., 2015).

Theoretical Gap and Conceptual Framework

Despite growing awareness of techno-eustress, the literature tends to treat personality and mindfulness as independent, not interactive, predictors of techno-eustress (Nascimento et al., 2024; Wang et al., 2023) and focuses mainly on Western contexts. This study uses a configurational approach that incorporates the Five-Factor Model (FFM) and IT mindfulness to develop personality profiles that can identify techno-eustress among Malaysian university students. This study combines FFM and MMT with the transactional model of stress and coping by focusing not on an individual trait but on the personality profiles as a whole to explain adaptive technology reactions (Grant & Langan-Fox, 2006). Figure 2 presents the conceptual framework.

Figure 2.

Conceptual framework



Integrating these three frameworks is theoretically necessary, as they provide additive, sequentially dependent layers to our model. First, the FFM establishes the baseline personality traits that dictate an individual's initial coping disposition. Second, the TSC structurally explains the cognitive appraisal process through which a student evaluates an IT demand as either a threat or a motivating challenge. Finally, the MMT explains the dynamic cognitive shift, showing how IT mindfulness acts as a crucial buffer that redirects attention, sparks positive reappraisal, and generates techno-eustress. Combined, they address gaps that no single framework can resolve alone.

Methodology

This study uses a pragmatic paradigm and fsQCA to examine configurations of personality traits, IT mindfulness, and techno-eustress. fsQCA brings together qualitative and quantitative logics to analyse configurational relations sensitive to case-specific differences (Ragin, 2008), and it captures the non-linear, interactive nature of personality while acknowledging multiple equifinal causal paths (Kahwati & Kane, 2018; Rihoux & Ragin, 2008).

Research Setting and Sampling

The study was conducted at a private Malaysian university that saw substantial declines in student engagement and academic performance during the transition to digital learning after the pandemic. Despite strong digital infrastructure, reports showed dropout rates above 50% and course failure rates rising from 1.14% (pre-pandemic) to over 25% under hybrid teaching. Counselling sessions also rose by 80%, showing significant technology-related stress. These conditions provided a relevant context for studying factors that support positive adaptation to digital learning.

A criterion-based purposive sampling strategy was used to select students who adapted successfully to online learning. Participants had to be registered for hybrid or online courses and have high academic achievement (A+, A, or A-) in assessments. This ensured the sample focused on students who excel in technology-mediated settings. The focus on high-achieving

students was theoretically motivated. Because techno-eustress reflects successful adaptation to technological demands, participants who performed strongly in online learning were considered information-rich cases that could provide insights into positive adaptation mechanisms. The final sample was comprised of 79 students (40.5% male and 59.5% female), mostly from business and IT programmes.

Measures and Measurement Model

Scales previously tested and validated were then modified to fit the context of this particular investigation. The Big Five Inventory with 44 items was used to measure personality traits (John et al., 1991); IT mindfulness was measured with a 12-item instrument (Thatcher et al., 2018); and techno-eustress was measured with five items from Nascimento et al. (2024). Each construct used a five-point Likert scale.

We confirmed reliability and validity through several statistical checks. All item loadings were larger than 0.70, and average variance extracted (AVE > 0.50) and composite reliability (CR > 0.70) were found to be evidence of internal consistency. We tested common method variance (CMV) by analysing variance inflation factors (VIFs), all of which were less than 3.3, and the heterotrait-monotrait ratio (HTMT) was less than 0.85, supporting discriminant validity (Hair et al., 2022).

fsQCA Procedure

We employed fuzzy-set qualitative comparative analysis (fsQCA), which identifies the causal combinations of personality traits that lead to techno-eustress in online learning. fsQCA is based on set theory and uses Boolean algebra to explore which combinations of conditions are sufficient to lead to a particular outcome (Ragin, 2014). In this study, a sufficient configuration refers to a personality profile that predisposes individuals to perceive high levels of techno-eustress, with each personality trait (openness to experience, conscientiousness, extraversion, agreeableness, neuroticism and IT mindfulness) represented as a fuzzy set. Fuzzy sets allow the researcher to quantify the extent of membership, indicating how high or low a personality trait is within a profile.

All constructs were measured using five-point Likert scales (1 = strongly disagree, 5 = strongly agree), and construct scores were computed as item-level means, yielding continuous values in the [1, 5] range. These means constituted the raw data submitted to the calibration procedure in fsQCA 4.1 (Ragin & Davey, 2022).

Using the direct method of calibration, raw scores were transformed into fuzzy-set membership scores ranging from 0 (full non-membership) to 1 (full membership). Anchors were placed at 2 (full non-membership), 3 (crossover point), and 4 (full membership), consistent with established practice for Likert-based instruments in fsQCA research (Kaya et al., 2020; Pappas & Woodside, 2021). A score of 3 represents the semantic and conceptual midpoint of this scale. This is the point of maximum ambiguity at which a case belongs neither clearly to the “high” nor the “low” category and is therefore the theoretically appropriate crossover anchor (Fiss, 2011). Using the direct method of calibration, we transformed raw continuous scores into fuzzy-set membership scores using anchors of 2 (full non-membership), 3 (crossover point), and 4 (full membership). To avoid excluding cases during truth table analysis, we adjusted crossover cases slightly to 0.501, following Fiss (2011).

Then, we performed a necessity analysis to identify any condition that acted as a very strong necessary antecedent of high techno-eustress. If the consistency score exceeded the typical cut-off of 0.9 (De Crescenzo et al., 2020), we classified the condition as necessary. Truth table analysis subsequently evaluated all possible configurations of the six conditions (personality

traits as causal conditions and techno-eustress as outcome). The few rows with fewer than two empirical cases were omitted because they might lead to conclusions based on possibly idiosyncratic cases, which is reasonable given the number of cases. We also omitted configurations with a consistency score below 0.90, consistent with the acceptable minimum for adequate condition identification in social science fsQCA studies (Ragin, 2008). Boolean minimisation removed redundant rows and generated the final parsimonious solution.

Results

Necessity Condition Analysis

Before examining configurations, we first test whether any single condition is necessary for techno-eustress. The review of the conditions needed for high techno-eustress showed that IT mindfulness is the only variable that exceeds the consistency threshold (>0.9), at 0.988. This implies that nearly all students with high levels of techno-eustress also use technology mindfully. Put simply, mindfulness in technology use precedes turning potential stress into positive, developmental experiences. Other personality dimensions, including conscientiousness, openness, and extraversion, were also useful but not sufficient to meet the necessity threshold, implying that their effects operate through a more complex configuration. The necessity analysis presented in Table 1 reveals that IT mindfulness demonstrated consistency levels exceeding the conventional threshold for necessity. Specifically, for high techno-eustress, consistency values range between 0.14 and 0.98.

Table 1.

Analysis of Necessary Conditions

Causal Conditions	Techno-Eustress	
	Consistency	Coverage
Extraversion	0.848823	0.895513
Neuroticism	0.145868	0.834623
Agreeableness	0.755669	0.874994
Conscientiousness	0.831401	0.876560
Openness to experience	0.851830	0.923914
IT Mindfulness	**0.988347**	0.895648

This finding suggests IT mindfulness functions as a highly consistent enabling condition across identified configurations. It is a necessary foundation upon which different personality configurations build distinct pathways to techno-eustress. Refer to Appendix A and B for the complete truth table, consistency values, PRI scores, raw coverage, unique coverage, and solution consistency.

Configuration Analysis

Having established IT mindfulness as necessary, we now examine how it combines with various personality traits to create sufficient conditions for techno-eustress. Figure 3 illustrates four intermediate-solution configurations associated with high techno-eustress. IT mindfulness is consistently present across all four configurations, while the other personality traits vary. Profiles 1 and 2 share high openness and extraversion but differ in conscientiousness and neuroticism. Profiles 3 and 4 demonstrate alternative combinations characterised by high conscientiousness and IT mindfulness. These findings illustrate equifinality, whereby different combinations of personality characteristics are associated with the same outcome.

These results indicate that multiple equifinal routes to techno-eustress exist, which responds to RQ1 by showing that no single personality type enables successful online learning adaptation. Instead, students can achieve positive technology-related stress through qualitatively different trait combinations:

1. Personality profile 1 (13% of cases): High openness to experience + High extraversion + High agreeableness + High IT mindfulness + Low conscientiousness.
2. Personality profile 2 (77% of cases): High openness to experience + High extraversion + High conscientiousness + High IT mindfulness + Low neuroticism.
3. Personality profile 3 (3% of cases): High conscientiousness + High IT mindfulness + Low extraversion + Low agreeableness + Low neuroticism + Low openness to experience.
4. Personality profile 4 (7% of cases): High neuroticism + High agreeableness + High conscientiousness + High IT mindfulness + Low extraversion + Low openness to experience.

To make the complex fsQCA findings more understandable, the researcher translated the original table into a simplified version that highlights the main findings. This simplified representation is meant to help readers unfamiliar with fsQCA and to illustrate the relationships between personality profiles and techno-eustress. Table 2 therefore brings the essential configurations and outcomes to the foreground, creating a more intuitive interpretation of how different personality profiles affect students' perceptions of techno-eustress.

Figure 3.

Configurations influencing the perception of high techno-eustress

	Configuration/Solution: Perception of high techno-eustress			
Configuration: Personality Traits	**1**	**2**	**3**	**4**
Openness to experience	●	●	⊗	⊗
Conscientiousness	⊗	•	•	•
Extraversion	•	•	⊗	⊗
Agreeableness	•		⊗	•
Neuroticism		⊗	⊗	•
IT Mindfulness	•	•	•	•
Consistency	0.989012	0.926165	0.930091	0.977711
Raw Coverage	0.147623	0.703085	0.0528285	0.0744663
Unique coverage	0.0724809	0.624964	0.0213788	0.0434482
Overall solution consistency	0.933294			
Overall solution coverage	0.842594			
Note: Black circles (●) indicate the presence of a condition and circles with "x" (⊗) indicate its absence. Large circle represents core condition, small circle represents peripheral condition, blank space represents "*don't care*" condition.				

Table 2.

Summary of personality profiles

Personality traits	Profile 1	Profile 2	Profile 3	Profile 4
No. of students	**9**	**53**	**2**	**5**
% of observation	**13%**	**77%**	**3%**	**7%**
Openness	√	√	X	X
Conscientiousness	X	√	√	√
Extraversion	√	√	X	X
Agreeableness	√	-	X	√
Neuroticism	-	X	X	√
IT Mindfulness	√	√	√	√
√ represent presence of trait; X represent absent of trait; - represent neutral				

In any profile, IT mindfulness is the enabling factor. Nevertheless, the configurational analysis indicates that IT mindfulness operates through varied mechanisms, depending on other personality traits, which we explain in detail in the discussion section.

Discussion

This study examined how personality and IT mindfulness enable techno-eustress in online learning and addressed two interrelated questions.

RQ1: What are the Personality Profiles of the Students?

fsQCA identified four configurations, indicating that techno-eustress occurs across multiple personality profiles.

One notable group includes those students who are open, extraverted and agreeable but less organised in their work; this group was called **Socially Engaged Learners**. Nine students (13% of the study population) were in this group. The second, and most dominant, profile includes emotionally stable, extraverted, conscientious, and open learners, with a combination of IT mindfulness; this profile was labelled **Resilient Organisers**. Fifty-three students (77% of the study population) represented this group, confirming it as the predominant group. The third group, labelled **Mindful Planners**, is characterised by high conscientiousness and IT mindfulness but low openness, agreeableness, and extraversion; two students (3%) fit this profile. The last group, **Cautious Strategists**, combines high neuroticism with high conscientiousness, agreeableness, and IT mindfulness, and five students (7% of all students) fit this profile.

These findings extend prior research threefold. First, whereas Pflügner et al. (2021) determined six personality profiles related to high-techno stressor perception, our paper identifies four profiles related to techno-eustress experiences, shifting from vulnerability to resilience. Second, although Maier et al. (2019) showed that personality and IT mindfulness co-create perceptions of technostress, our configurational approach identifies which trait combinations may result in positive stress perceptions and how IT mindfulness works differently across profiles. Third, our findings respond to Nascimento et al.'s (2024) request to investigate individual differences by showing the same positive outcome achieved through qualitatively different mechanisms.

RQ2: To What Extent do they Empower Students to View IT Demands as Techno-Eustress?

The fsQCA revealed four personality profiles that empower the students to interpret IT demands as techno-eustress. The most prominent profile, i.e., the Resilient Organisers (Group 2), is characterised by high openness to experience, high extraversion, high conscientiousness, high

IT mindfulness, and low neuroticism. Their personality characteristics may be associated with traits that make them particularly capable of turning IT challenges into positive stress. This configuration may represent a common pathway through which students experience techno-eustress, combining systematic planning and flexibility with strong self-regulatory ability. Their neuroticism and extraversion foster engagement, and their low neuroticism maintains emotional balance (Maier et al., 2019; Shirish et al., 2021). Consistent with "resilient" types (Robins et al., 1996), these learners show intelligence, adaptability, and positive behaviour. IT mindfulness strengthens their purposeful, practice-based approach to using technology, making them proactive, independent, and collaborative digital learners in a technology-rich world.

Next, the socially engaged innovators (Group 1) were another significant group, exhibiting high openness, extraversion, agreeableness, and IT mindfulness, along with low conscientiousness. Their ability to navigate IT demands creatively and socially helps them view stressors positively. These learners flourish in technology-rich environments that encourage curiosity and collaboration. Their openness fuels enthusiasm for digital technology, and extraversion and agreeableness build social support networks that ease technological stress. IT mindfulness helps them stay focused and adaptable in less structured settings (Agarwal & Prasad, 1998). This resembles "resilient undercontrolled" profiles (Bohane et al., 2017; Robins et al., 1996). This group of students may struggle with procrastination and self-regulation under online pressures (Chowdhury et al., 2018).

Next, the cautious strategists (Group 4) displayed high conscientiousness, agreeableness, neuroticism, and IT mindfulness, with low openness and extraversion. Their tendency to manage tasks carefully and strategically also supports their positive perception of IT stressors, despite higher neuroticism. These learners enter tech-rich spaces alert and careful, turning potential anxiety into intelligent, observant participation. Neuroticism is not exclusively maladaptive, as the clinical hypersensitivity of a high empathiser can increase preparedness and motivation rather than distress. (Srivastava et al., 2015; Zellars et al., 2006). Although this particular personality profile is not reported in previous research, a combination of several traits in this profile is similar to the "overcontrolled" type (Robins et al., 1996; Walker & Koralesky, 2021), characterised by an overabundance of self-control, emotional repression, and perfectionism. When balanced with mindfulness and thoughtful effort, these characteristics may produce thoughtful, observant coping and cautious use of technology in learning environments.

Lastly, the mindful planners (Group 3) have the fewest students. This group is characterised by high conscientiousness and IT mindfulness but low levels of openness, extraversion, agreeableness, and neuroticism. Despite their lower emotional adaptability, their strong organisational skills allow them to manage IT demands effectively. They are independent, structured, and predictable learners who thrive in a structured technological, non-social learning environment (Nitzl et al., 2024; Shirish et al., 2021). Their attention helps them to experience techno-eustress as a productive challenge. Consistent with the "resilient overcontroller" profile (Gramzow et al., 2004; Schnabel et al., 2002), they show emotional stability, caution, and disciplined problem-solving, suggesting that disciplined, individualised strategies can help students experience positive technology-related stress.

Theoretical Contribution

This research makes several key contributions by addressing students' personality profiles (RQ1) and explaining how they enable students to view IT demands as techno-eustress (RQ2).

First, IT mindfulness is a highly consistent necessary condition (consistency = 0.988) for

techno-eustress across all four personality profiles. This supports Thatcher et al. (2018)'s argument that IT mindfulness directly affects technology adaptation. This finding elevates IT mindfulness to an indispensable prerequisite rather than a merely "helpful" factor, radically transforming intervention design.

Second, the study identifies four equifinal paths to techno-eustress, strengthening the theory by showing that the same positive outcome can occur through qualitatively different mechanisms. This responds to Nascimento et al.'s (2024) call for research on individual differences and questions the idea of a "one-size-fits-all" approach to intervention. The study also extends the understanding of MMT by incorporating personality profiles and IT mindfulness traits into the outcome, where positive stress works with different emphasis across profiles.

Third, while IT mindfulness is universally necessary, it operates through distinct mechanisms across personality profiles. Our findings extend Garland et al. (2015) and Garland et al. (2017) Mindfulness-to-Meaning Theory (MMT) by showing that the direct route between mindfulness and positive outcomes is not general but depends on personality traits. MMT suggests that mindfulness allows for positive reappraisal through 3 steps: (1) metacognitive awareness of initial stress appraisals, (2) decentering from automatic negative interpretations, and (3) positive reappraisal that generates meaning and growth. Our results suggest that these steps operate differently with varying emphasis across profiles. Socially Engaged Innovators use decentering and reappraisal. Resilient Organisers incorporate all three steps seamlessly. Mindful Planners use metacognitive awareness of system information, and Cautious Strategists use awareness and decentering to control anxiety. Thus, mindfulness works differently across personalities, which may imply that mindfulness interventions should match people's cognitive-emotional styles rather than take a one-size-fits-all approach.

Fourth, our study reconceptualises personality-stress relationships and challenges variable-centred analyses. High neuroticism can be a positive contributing factor when paired with conscientiousness, agreeableness, and IT mindfulness (Cautious Strategists), turning emotional sensitivity into a positive adaptive function in certain situations (Zellars et al., 2006). Similarly, the success of low-conscientiousness students (Socially Engaged Learners), when supported by high openness, extraversion, agreeableness, and IT mindfulness, can be seen as a compensatory trait mechanism. These findings suggest that leveraging personality strengths may be more effective than addressing individual deficits in educational intervention.

Lastly, our study extends the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984) by showing how personality configurations influence appraisal processes in technology-mediated learning. Different profiles use different cognitive strategies. For instance, Resilient Organisers struggle with confidence and seek creative solutions, while Cautious Strategists show anticipatory, disciplined problem solving. These patterns suggest that personality configurations may reflect how different students cope with and respond to technology stress.

Practical Implications

The research findings provide evidence-based information for educational practice for different stakeholders. At the student level, identifying personality profiles helps provide individual, student-specific support strategies. Empirical evidence suggests that personality features can change after a demanding event (Sutin et al., 2010). Engagement in IT training, peer mentoring and digital wellness programmes can help students to manage the demands of IT more effectively (Loos, 2017; Shirish et al., 2021). Encouraging collaboration and social support may also help introverted students to counteract the stress and improve engagement.

At the teaching and learning level, educators may adjust their approach to students' personality

profiles and provide personalised support. Students with high neuroticism, for instance, may struggle with new technology and benefit from individual feedback and extra guidance. Those with low IT mindfulness may need reinforcement of the benefits of digital tools to engage more deeply (Wu et al., 2022). A step-by-step approach allows educators to introduce complex IT tasks gradually while offering opportunities for peer collaboration and structured feedback, helping transform technological stress into constructive engagement.

At the institutional level, institutions of higher learning (IHLs) can provide strong technical support systems, including help desks, online tutorials, and peer mentoring programmes, to prevent minor technical difficulties from becoming barriers to learning (Al-Fraihat et al., 2020). Promoting group projects and discussion forums helps reduce isolation and, in turn, inspires student motivation and persistence in online learning (Farrell & Brunton, 2020). Additionally, IHLs can integrate stress management seminars and IT mindfulness programmes into their student support services. To help students navigate online learning more successfully, these programmes can include time management, digital wellness, and technological balance (Igwe et al., 2022).

Lastly, at the policy level, policymakers may consider introducing IT mindfulness training into academic courses to help students and educators develop a balanced approach to technology use (Bossi et al., 2022). Investments in professional development programmes can equip educators with strategies to support students struggling with digital tools. This helps provide a more inclusive online learning experience for students. Equitable access to digital resources is also important. Policymakers could advocate for funding to give underprivileged students access to devices, software, and reliable internet so they have equal opportunities in digital education. These initiatives will help develop a more accessible, student-centred learning environment that encourages positive engagement with technology.

Conclusion

This paper identified four unique personality configurations (RQ1) and how they interact to help students view IT demands as techno-eustress (RQ2). The current results outline profile-specific strategic mechanisms of adaptation, such as using compensation strategies to address low self-regulation, strengthening pre-existing attributes, maximising systematic involvement, and converting anxiety into purposeful preparation. Importantly, these findings also challenge deficit-oriented premises by showing that attributes many individuals view as deficits can actually lead to positive technology experiences. For example, students who score low on conscientiousness and high on neuroticism may benefit from digital learning when working with IT mindfulness and using complementary strengths. Rather than pursuing a universal ideal learner profile or prescribing uniform mindfulness interventions across all students, IHLs may benefit from recognising the diversity of adaptive trajectories suggested by these findings, while acknowledging that further evidence from broader and more diverse samples is needed before profile-specific recommendations can be implemented with confidence at scale. By fostering appropriate personality traits, IHLs may better support digital well-being and academic success among heterogeneous groups of learners in technology-intensive environments.

This study has several limitations. First, criterion-based purposive sampling limits the findings' transferability. The configurations identified here pertain specifically to high-achieving students at a single private Malaysian university. They may not translate to students at different achievement levels, across diverse disciplinary contexts, or in other national and cultural settings. Future research should aim for larger samples, greater sample diversity, and multi-institutional designs to validate these results. Second, two of the four profiles identified (Profiles 3 and 4) involve very few cases (2 and 5, respectively) and thus should be viewed as

exploratory and tentative until they can be replicated. Third, the cross-sectional nature of the study does not allow inferences about how these profiles evolve or change as digital learning environments are used over time. Longitudinal designs would be useful for investigating whether specific institutional interventions can develop IT mindfulness and lead to the configurational outcomes revealed in this study.

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Appendix A: Truth Table

EX	NE	AG	CO	OE	IT	No.	TE	Raw Con.	Pri Con.	Sym Con.
1	1	1	0	1	1	3	1	0.987717	0.986606	0.986606
1	0	0	1	1	1	12	1	0.986507	0.986173	0.986173
1	0	1	0	1	1	6	1	0.985814	0.984782	0.984782
0	1	1	1	0	1	5	1	0.977711	0.976494	0.976494
0	0	0	1	0	1	2	1	0.930091	0.92245	0.92245

1	0	1	1	1	1	41	1	0.906428	0.904167	0.913725
1	0	1	1	0	1	3	0	0.823438	0.809725	0.809724
Notes: EX=Extraversion, NE=Neuroticism, AG=Agreeableness, CO=Conscientiousness, OE=Openness to experience, IT=IT Mindfulness, TE=Techno-Eustress										

From the table, it is observed that the configuration EX=1, NE=1, AG=1, CO=0, OE=1, IT=1, with 3 cases, has high consistency scores (Raw Con. 0.9877, Pri Con. 0.9866, Sym Con. 0.9866), suggesting strong alignment with the outcome. Conversely, configurations with lower consistency scores, such as EX=1, NE=0, AG=1, CO=1, OE=0, IT=1, show weaker associations, indicating these trait combinations are less likely to lead to the perception of techno-eustress. Overall, the analysis demonstrates that specific personality profiles, particularly those with higher levels of the Big Five and IT mindfulness traits, are more likely to perceive techno-eustress, highlighting the importance of these traits in understanding individual responses to IT demands.

Appendix B: Intermediate Solution Output

frequency cutoff: 2
consistency cutoff: 0.906428
Assumptions:

	raw coverage	unique coverage	consistency
Extraversion*Agreeableness*~Conscientiousness *Openness*ITMindfulness	0.147623	0.0724809	0.989012
Extraversion*~Neuroticism*Conscientiousness *Openness*ITMindfulness	0.703085	0.624964	0.926165
~Extraversion*~Neuroticism*~Agreeableness *Conscientiousness*~Openness*ITMindfulness	0.0528285	0.0213788	0.930091
~Extraversion*Neuroticism*Agreeableness *Conscientiousness*~Openness*ITMindfulness	0.0744663	0.0434482	0.977711

solution coverage: 0.842594
solution consistency: 0.933294

Cases with greater than 0.5 membership in term Extraversion*Agreeableness*~Conscientiousness*Openness*ITMindfulness:
51 (0.979,0.991), 37 (0.871,0.991), 9 (0.821,0.991), 30 (0.789,0.991), 17 (0.659,1), 78 (0.591,0.991), 39 (0.579,0.991), 13 (0.501,0.991), 33 (0.501,0.861)

Cases with greater than 0.5 membership in term Extraversion*~Neuroticism*Conscientiousness*Openness*ITMindfulness:
50 (0.999,1), 35 (0.991,1), 58 (0.991,1), 56 (0.991,1), 74 (0.991,0.991), 71 (0.991,1), 69 (0.991,0.991), 65 (0.991,0.011), 64 (0.991,1), 4 (0.989,0.231), 79 (0.989,0.991), 18 (0.989,0.991), 20 (0.989,0.991), 75 (0.989,0.991), 2 (0.981,1), 43 (0.981,1), 23 (0.981,1), 31 (0.981,1), 21 (0.979,0.991), 70 (0.979,0.991), 54 (0.971,1), 45 (0.971,0.971), 42 (0.971,0.771), 40 (0.969,0.991), 12 (0.969,0.991), 11 (0.951,0.991), 27 (0.951,0.991), 26 (0.951,0.991), 25

(0.951,0.011), 24 (0.951,1), 55 (0.941,1), 57 (0.941,1), 60 (0.941,1), 61 (0.941,1), 62 (0.941,1), 32 (0.941,1), 66 (0.941,0.991), 72 (0.941,1), 48 (0.921,1), 44 (0.921,1), 36 (0.921,1), 67 (0.921,0.991), 68 (0.921,1), 28 (0.921,1), 38 (0.911,0.971), 47 (0.901,1), 3 (0.871,0.031), 5 (0.869,1), 10 (0.821,0.991), 14 (0.819,0.991), 76 (0.751,0.991), 53 (0.501,0.991), 34 (0.501,0.991)

Cases with greater than 0.5 membership in term ~Extraversion*~Neuroticism*~Agreeableness*Conscientiousness*~Openness*ITMindfulnes: 19 (0.789,0.991), 16 (0.729,0.861)

Cases with greater than 0.5 membership in term ~Extraversion*Neuroticism*Agreeableness*Conscientiousness*~Openness*ITMindfulness: 15 (0.971,0.991), 73 (0.709,0.991), 63 (0.649,1), 49 (0.589,1), 59 (0.581,1)

Biodata

Dr. Lim Thean Pheng, a distinguished Assistant Professor at Tunku Abdul Rahman University of Management and Technology, is recognised for expertise in technology acceptance, behaviour, and student engagement. Holding degrees in management, IT, and doctoral in business administration, and affiliated with prestigious global institutes, he is a respected authority bridging academic excellence and industry leadership.

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