# When Technostress Enhances Performance: The Adaptive Role of Coping Appraisal

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**Abstract.** This study examines the relationships between technostress, coping appraisal, and academic performance by drawing on Protection Motivation Theory (PMT). Rather than viewing technostress solely as a detrimental condition, this research emphasises the role of coping appraisal as a key cognitive mechanism through which individuals evaluate their capacity to manage technology related demands. Using a quantitative approach, data were collected through an online survey of postgraduate accounting students enrolled in a leading Indonesian business school during the period of fully remote learning amid the COVID-19 pandemic. From 317 responses obtained, 315 were retained for analysis. The findings indicate that coping appraisal has a significant positive effect on both task performance and contextual performance, suggesting that it functions as an adaptive psychological resource under conditions of intensive technological pressure. In addition, technostress itself is found to exert a positive and significant influence on both dimensions of performance. This result implies that, within highly digitalised learning environments, technostress may operate as a challenge stressor that encourages greater focus, engagement, and productivity rather than hindering performance. Overall, this study extends the application of PMT to technology enhanced learning contexts and highlights the importance of strengthening coping appraisal to sustain performance in environments characterised by ongoing digital change. The findings also reaffirm the continuing relevance of technostress research in the post pandemic era, as digital transformation increasingly shapes learning processes, work practices, and professional development.

**Keywords:** Technostress, Coping Appraisal, Protection Motivation Theory, Task Performance, Contextual Performance, Digital Learning

## 1 Introduction

The rapid digitalisation of higher education accelerated by the COVID-19 pandemic has fundamentally reshaped how accounting students engage with technology in their learning activities. Modern accounting education requires students to work extensively with cloud-based learning platforms, online assessment systems, Enterprise Resource Planning (ERP) simulations, and numerous Accounting Information Systems (AIS). This increasing technological integration exposes students to dynamic digital conditions, including sudden system updates, recurrent software changes, and unstable learning platforms. Such instability gives rise to technological uncertainty, a form of technostress that remains insufficiently examined within technology-enhanced accounting education.

Existing technostress research consistently characterises technology-induced pressures as detrimental to students' learning and psychological well-being. Studies report that rapid technological changes increase anxiety, cognitive overload and disengagement [1], [2], while unstable digital platforms heighten frustration and disrupt academic continuity [3]. Within Technology-Enhanced Learning (TEL), stressors such as digital complexity, inconsistent interfaces and excessive technological demands are widely associated with reduced performance and diminished motivation [4], [5]. In AIS-based coursework where system navigation, data accuracy and procedural precision are

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central, these stressors are assumed to impair both task-related activities (e.g., data entry, reconciliation, analytics) and contextual behaviours (e.g., collaboration, initiative, adaptability).

However, recent theoretical developments challenge the view that technostress is uniformly harmful. The challenge–hindrance framework suggests that stressors may stimulate adaptive responses when perceived as manageable challenges rather than threats. Protection Motivation Theory (PMT) posits that coping appraisal especially perceived self-efficacy plays a decisive role in shaping individuals' behavioural responses to stress. Similarly, Attentional Control Theory [6] suggests that individuals who possess stronger attentional resources are better able to sustain or redirect their focus when operating under pressure. Taken together, these perspectives imply that technological uncertainty does not necessarily undermine student performance; instead, under certain psychological conditions, it may encourage more adaptive and productive learning responses.

However, despite these theoretical arguments, empirical evidence supporting the positive role of technostress remains scarce. This limitation is particularly evident in highly professionalized fields such as accounting, where rapid technological change and system volatility are an inherent part of learning and practice. Much of the Technology-Enhanced Learning (TEL) literature continues to highlight the negative consequences of digital instability, leaving an important gap in understanding whether and how students can harness technological uncertainty to improve their academic outcomes. This gap is especially relevant because AIS learning environments naturally involve evolving technologies, routine disruptions and system modifications that students cannot avoid.

At this point, the present study holds particular relevance for accounting educators. Accounting students are consistently exposed to technological complexity and system-related uncertainty, as their coursework requires ongoing interaction with Accounting Information Systems (AIS), ERP environments, digital audit tools, and cloud-based platforms. Gaining insight into how students perceive technological uncertainty, and how psychological factors such as perceived self-efficacy influence their responses, is therefore crucial for educators when developing instructional approaches, assessment designs, and learning support structures. By clarifying how technostress operates within AIS-based learning contexts, educators may better address digital fatigue, foster digital resilience, and support students' preparedness for technology-intensive professional roles.

To address this gap, the present study investigates how technostress specifically the pressures arising from technological instability affects accounting students' academic performance. In particular, it examines the role of perceived self-efficacy as a cognitive appraisal mechanism that determines whether technological uncertainty is interpreted as a barrier or as a catalyst for adaptive learning. Rather than assuming that technostress exerts a uniformly negative influence, this study explores how students cognitively evaluate technology-induced pressures and how such evaluations shape their task and contextual performance.

This research makes several contributions. Theoretically, it advances technostress literature by demonstrating that responses to technology-induced pressures depend heavily on cognitive appraisal processes, thereby challenging the traditional assumption that technostress is consistently harmful. The study integrates PMT, U-Shape Theory, Attentional Control Theory and the TEL framework to explain why technological uncertainty may yield positive academic outcomes under specific psychological conditions. Practically, the findings offer actionable insights for accounting educators and programme designers to develop interventions that strengthen students' technological self-efficacy and harness digital uncertainty as an adaptive, performance-enhancing stressor.

In sum, this study seeks to provide a more comprehensive understanding of how technostress shapes academic performance within increasingly digitalised accounting education, and to identify the psychological conditions that enable technological uncertainty to become a constructive force in learning.

Taken together, beyond its theoretical contributions, this study offers practical implications for universities and accounting education institutions operating in technology-intensive learning environments. The findings offer practical direction for the development of digital learning strategies, student support initiatives, and curriculum designs that aim to strengthen students' coping appraisal and perceived self-efficacy when dealing with technological uncertainty. These insights are especially valuable for higher education institutions that seek to improve student performance and build resilience within post-pandemic digital and hybrid learning environments.

## 2 Theoretical framework

This study is grounded in Protection Motivation Theory (PMT) as the primary theoretical framework to explain how individuals cognitively evaluate and respond to technology-induced stressors. PMT posits that individuals' behavioural and performance outcomes are shaped by their appraisal of coping capabilities, particularly perceived self-efficacy, when confronted with perceived threats or demands. Within technology-enhanced accounting education, techno-uncertainty represents a salient form of technostress that activates coping appraisal processes as students assess their ability to manage unstable digital learning environments.

To complement PMT, this study draws on the U-shape theory of stress and performance, Attentional Control Theory, and the Technology-Enhanced Learning (TEL) perspective. The U-shape theory explains how technological stressors may function as challenge stressors that enhance performance when perceived as manageable. Attentional Control Theory clarifies the cognitive mechanisms through which individuals regulate attention and effort under stressful technological conditions, while TEL provides the contextual foundation of digitally mediated learning environments. Together, these theoretical perspectives explain the relationships among technostress, coping appraisal, and task and contextual performance, forming the conceptual basis for the hypotheses developed in the following section.

**2.1 Hypothesis Development**

Technostress has traditionally been defined as a maladaptive response to technology-driven pressures that disrupt cognitive, emotional and behavioural functioning [7]. Within higher education especially in disciplines requiring intensive interaction with digital systems such as AIS, students are routinely exposed to unstable platforms, rapidly changing software interfaces and unexpected system errors. Such volatile conditions heighten technological uncertainty, a form of technostress that triggers cognitive evaluation of one's ability to cope [3].

**Technostress and Coping Appraisal**

Protection Motivation Theory (PMT) posits that individuals assess stressful situations through *coping appraisal*, which reflects confidence in their capability to manage emerging threats. Techno-uncertainty stemming from abrupt system changes and inconsistent digital environments—activates these evaluative processes. Prior studies show that exposure to technology-induced disruptions prompts users to mentally assess their competence, problem-solving ability and control over digital tasks [8], [9]. Consequently, experiencing technostress may lead students to increase their coping appraisal as they attempt to regain control in unstable technological environments.

H1. Technostress positively influences Coping Appraisal.

**Technostress and Performance**

The conventional view suggests that technostress diminishes academic performance by increasing cognitive load and reducing attentional capacity [1], [2]. However, newer perspectives particularly the challenge–hindrance stressor framework argue that certain stressors may enhance performance when perceived as challenges rather than barriers. In AIS-based learning, where accuracy, vigilance and careful system navigation are required, technology-induced uncertainty may encourage students to exert additional effort, adopt more strategic study behaviours and engage more deeply in their tasks.

Such adaptive mechanisms may enhance both:

- Contextual performance (CP) in this study refers to students' collaborative behaviors, initiative, and adaptability when engaging with technology-intensive learning tasks.
- Task performance (TP), in contrast, reflects the accuracy, efficiency, and completeness with which students carry out core academic and system-related activities.

H2.Technostress positively influences Contextual Performance

H3. Technostress positively influences Task Performance

**Coping Appraisal and Performance**

Both PMT and Attentional Control Theory [6] suggest that individuals who possess strong coping appraisal, particularly in terms of perceived self-efficacy are better equipped to function effectively under stressful conditions. Rather than losing focus, they are more likely to regulate their attention and cognitive effort while remaining motivated. Within technology-enhanced accounting learning environments, students with high coping appraisal tend to handle digital disruptions more effectively, manage task complexity with greater confidence, and persist even when system instability occurs.

This strengthens both performance dimensions:

- CP, through enhanced initiative, engagement and willingness to assist peers;
- TP, through improved accuracy, problem-solving and task completion.

H4. Coping Appraisal (CA) positively influences Contextual Performance.

H5. Coping Appraisal (CA) positively influences Task Performance.

## 3 Research Method

### 3.1 Data Collection and Variable Measurement

Data were collected over a three-month period between July and September 2021, during the phase of fully remote learning implemented in response to the COVID-19 pandemic. The study involved postgraduate accounting students who were enrolled in Accounting Information Systems (AIS)-related courses at a leading business school in Indonesia. The sample included accounting students from cohorts starting from the 2016 academic year onwards, who were actively engaged in technology-intensive coursework during the data collection period.

Participants were given adequate time to take part in the study on a voluntary basis, and confidentiality was maintained by omitting personally identifiable information, including names, dates of birth, and residential details. The respondents ranged in age from 20 to 40 years and represented active learners engaged in AIS-related coursework. Before the questionnaire was distributed, it was reviewed by subject experts and pilot tested to ensure that the items were clear, relevant, and consistent with the study's conceptual framework.

The measurement items used in this study were drawn from established scales commonly employed in prior research on technostress, coping appraisal, and Technology-Enhanced Learning (TEL). Minor contextual adjustments were applied to reflect the AIS-oriented learning environment. All constructs were assessed using a five-point Likert-type scale, with response options ranging from "strongly disagree" (1) to "strongly agree" (5). Data analysis was conducted at the individual level, consistent with prior research examining technology-induced stress and behavioural responses in educational settings.

Postgraduate accounting students were selected as the study sample rather than undergraduate students because they are more intensively exposed to complex and professionally oriented digital systems. At the postgraduate level, accounting programs place strong emphasis on advanced Accounting Information Systems (AIS), Enterprise Resource Planning (ERP) simulations, and the use of digital auditing tools. Many postgraduate accounting students also bring prior professional or industry experience into the learning environment, which allows them to interpret and respond to technological stressors in ways that more closely reflect real-world accounting practice. This enhances the relevance of the findings for understanding adaptive responses to technostress in both academic and professional settings.

The educational background reported in Table 1 refers to the highest completed degree prior to the respondents' current postgraduate enrolment. All respondents were enrolled as postgraduate students at the time of data collection.

### 3.2 Validity, Reliability, and Statistical Analysis

A series of analytical procedures was conducted to evaluate both the measurement model and the structural model. The analysis employed Partial Least Squares Structural Equation Modelling (PLS-SEM) using SmartPLS 3.0, as this approach is well suited for prediction-oriented research, accommodates models with multiple latent constructs, and allows for the examination of complex relationships within educational technology contexts.

Measurement Model Evaluation

The measurement model was assessed through:

- Convergent validity, evaluated using outer loadings (> 0.70), Average Variance Extracted (AVE > 0.50) and item-to-total correlations.
- Discriminant validity, evaluated using Fornell–Larcker criteria and the Heterotrait–Monotrait Ratio (HTMT < 0.85).

These assessments ensured that each construct was measured accurately, consistently and distinctly.

Reliability Testing

Internal consistency reliability was examined using:

a. Cronbach's Alpha ($\alpha > 0.70$), and
b. Composite Reliability (CR > 0.70).

Both indicators confirmed that the measurement instruments demonstrated satisfactory reliability.

Structural Model Evaluation
Once the measurement model demonstrated adequate psychometric properties, the structural model was analysed using:

a. Path coefficients (β) and t-statistics generated through bootstrapping (5,000 subsamples),
b. Coefficient of determination ($R^2$ and Adjusted $R^2$) to evaluate explanatory power,
c. Effect sizes ($f^2$) to assess the contribution of each predictor,
d. Predictive relevance ($Q^2$) through blindfolding procedures, and
e. Model fit indices, including Standardized Root Mean Square Residual (SRMR < 0.08).

The results indicated that the structural model achieved acceptable fit, demonstrated meaningful predictive capability and revealed statistically significant relationships among the study variables.

## 4 Statistical Result and Findings

### 4.1. Descriptive Statistics

In this study, the data were obtained from master's and doctoral accounting students enrolled at leading universities in Indonesia. Many respondents also reported prior professional experience in accounting-related roles, such as accounting instruction, auditing, and assurance services. The similarity in their academic backgrounds and professional exposure suggests that the sample is relatively homogeneous, which supports the consistency of the measurement results.

The measurement assessment indicates that the dataset satisfies the required psychometric criteria in terms of convergent validity, discriminant validity, and construct reliability. All indicators show satisfactory loading values, and the AVE, Fornell–Larcker criterion, cross-loadings, HTMT ratios, Cronbach's alpha, and composite reliability values remain within acceptable ranges. Despite the challenges faced during respondent recruitment, the overall quality and reliability of the data were maintained. Table 1 summarises the demographic characteristics of the respondents.

**Table 1.** Demography of Respondents

| Respondents | Frequency | Percentage |
|---|---|---|
| **Gender:** | | |
| Male | 91 | 28.9% |
| Female | 224 | 71.1% |
| **Age:** | | |
| >40 years old | 144 | 45.71% |
| 36-39 years old | 101 | 32.06% |
| 31-35 years old | 26 | 8.25% |
| 26-30 years old | 39 | 12.38% |
| 20-25 years old | 5 | 1.59% |
| **Education:** | | |
| Bachelor | 98 | 31.1% |
| Master | 217 | 68.9% |

Note: n= 315

Table 2 shows that all items have factor loadings exceeding the recommended threshold of 0.50, indicating satisfactory convergent validity. Consistent with this result, each construct achieved acceptable AVE values and met the criteria for discriminant validity based on the Fornell–Larcker criterion, cross-loadings, and HTMT ratios. In addition, all variables produced p-values of 0.000, reflecting statistically significant relationships among the constructs and supporting the proposed hypotheses. Overall, these results indicate that the measurement model demonstrates adequate psychometric quality and is suitable for subsequent structural analysis.

**Table 2.** Convergent Validity of Instrument

| Construct | Loading Factor | P-Value | AVE | Fornell–Larcker Criterion | Heterotrait-Monotrait (HTMT) | Ratio |
|---|---|---|---|---|---|---|
| **TU1** | 0.795 | 0.000 | | | Technostress to --> | |
| **TU2** | 0.872 | 0.000 | 0.709 | 0.842 | CA | 0.242 |
| **TU3** | 0.907 | 0.000 | | | CP | 0.616 |
| **TU4** | 0.786 | 0.000 | | | TP | 0.482 |
| **PSE2** | 0.923 | 0.000 | | | | |
| **PSE3** | 0.847 | 0.000 | 0.767 | 0.876 | | |
| **PSE4** | 0.856 | 0.000 | | | | |
| **TP1** | 0.831 | 0.000 | | | TP to --> | |
| **TP4** | 0.892 | 0.000 | 0.719 | 0.848 | CA | 0.504 |
| **TP5** | 0.841 | 0.000 | | | CP | 0.615 |
| **TP9** | 0.828 | 0.000 | | | | |
| **CP1** | 0.826 | 0.000 | | | CP to --> | |
| **CP3** | 0.826 | 0.000 | | | CA | 0.559 |
| **CP4** | 0.752 | 0.000 | | | | |
| **CP5** | 0.840 | 0.000 | | | | |
| **CP6** | 0.820 | 0.000 | 0.637 | 0.798 | | |
| **CP7** | 0.811 | 0.000 | | | | |
| **CP8** | 0.728 | 0.000 | | | | |
| **CP9** | 0.815 | 0.000 | | | | |
| **CP12** | 0.756 | 0.000 | | | | |

Table 3 indicates that the dataset shows satisfactory measurement quality, as reflected in acceptable collinearity levels across all indicators. The VIF values remain within the recommended limits, suggesting that multicollinearity is not a concern and that each indicator contributes meaningfully to its corresponding latent construct. The reliability assessment also points to strong internal consistency. Cronbach's alpha values for Contextual Performance, Coping Appraisal, Task Performance, and Technostress exceed the recommended thresholds, indicating stable measurement. In addition, the composite reliability values for the relevant constructs are above the 0.7 benchmark, further supporting the reliability of the measurement instruments. Overall, these findings suggest that the variables included in this study satisfy the required criteria for reliability and validity, providing a sound basis for subsequent structural analysis and the examination of relationships among the constructs.

**Table 3.** Validity and Reliability Results

| Variables | Items | Collinearity (VIF) | Cronbach's Alpha | Composite Reliability |
|---|---|---|---|---|
| Contextual Performance | CP1 | 2.605 | 0.929 | 0.940 |
| | CP12 | 2.316 | | |
| | CP3 | 3.821 | | |
| | CP4 | 2.964 | | |

| | | | | |
|---|---|---|---|---|
| | CP5 | 3.153 | | |
| | CP6 | 2.865 | | |
| | CP7 | 3.782 | | |
| | CP8 | 2.930 | | |
| | CP9 | 4.020 | | |
| Coping Appraisal | PSE2 | 2.450 | 0.849 | 0.908 |
| | PSE3 | 1.973 | | |
| | PSE4 | 1.990 | | |
| Task Performance | TP1 | 2.458 | 0.871 | 0.911 |
| | TP4 | 3.076 | | |
| | TP5 | 2.330 | | |
| | TP9 | 1.967 | | |
| Technostress | TU2 | 3.455 | 0.861 | 0.906 |
| | TU3 | 4.191 | | |
| | TU4 | 1.647 | | |
| | TU1 | 1.690 | | |

**4.2. Model and Association Results**

The statistical results for the structural model are presented in Table 4. The analysis begins by examining the direct effects to identify the primary mechanisms through which technostress and coping appraisal influence performance. The findings indicate that technostress has a positive and significant effect on coping appraisal, with a path coefficient of 0.215 and a highly significant p-value at the 1% level, thereby supporting Hypothesis H1a. This result suggests that heightened technological pressures motivate individuals to increase their cognitive efforts in evaluating and managing technology-related demands.

The results show clear support for Hypothesis H2a, indicating a positive and significant relationship between technostress and contextual performance ($\beta = 0.365$; $p < 0.001$), with technostress accounting for 34.3% of the variance. This pattern suggests that exposure to technological pressure may encourage individuals to increase their engagement in contextual behaviors as a form of adaptive response. In a similar vein, Hypothesis H3a is also supported, as technostress has a positive effect on task performance ($\beta = 0.148$; $p < 0.001$). Although this effect is comparatively smaller, it indicates that technological pressure can still contribute to improvements in task-related performance, potentially by promoting greater vigilance or sustained effort.

The analysis also supports Hypotheses H4a and H5a, showing that coping appraisal is positively and significantly associated with both dimensions of performance. Coping appraisal has a positive effect on contextual performance ($\beta = 0.391$; $p < 0.001$), suggesting that individuals with stronger evaluative and coping capabilities tend to engage more frequently in constructive extra-role behaviours. In addition, coping appraisal exhibits a strong positive influence on task performance ($\beta = 0.575$; $p < 0.001$), which represents the largest effect observed in the model. Together, these results highlight the importance of cognitive coping mechanisms in helping individuals sustain and enhance performance when facing technological pressure.

The pattern of direct effects suggests that both technostress and coping appraisal play an important role in shaping performance outcomes. Technostress influences performance not only indirectly through coping appraisal but also through its direct effects on both contextual and task performance. At the same time, coping appraisal consistently contributes to improvements across both performance dimensions, indicating its role in supporting individuals' adaptive responses within technology-intensive work environments.

**Table 4.** Result of Hypothesis

| **Causalities** | R-Square | Path Coefficient | P-Value | Result |
|---|---|---|---|---|
| H1a. Tech.S ↔ CA | 0.043 | 0.215 | 0.000*** | Support |
| H2a. Tech.S ↔ CP | 0.343 | 0.365 | 0.000*** | Support |

| | | | | |
|---|---|---|---|---|
| H3a. Tech.S ↔ TP | 0.366 | 0.148 | 0.000*** | Support |
| H4a. CA ↔ CP | | 0.391 | 0.000*** | Support |
| H5a. CA ↔ TP | | 0.575 | 0.000*** | Support |

## 5 Research Findings

The present study examined postgraduate accounting students enrolled at a leading public university in Indonesia during the COVID-19 emergency shift to online learning. The structural model shows that technostress had a positive and significant effect on coping appraisal and, through this pathway, enhanced both contextual and task performance. Rather than observing a purely detrimental pattern, technostress in this setting operated as a *motivational* and *performance-enhancing* condition when students perceived themselves as capable of coping. This finding is notable given that much of the COVID-19 technostress literature reports negative outcomes for students' learning, well-being and satisfaction (Saleem et al., 2024).

### 5.1 Positioning the Findings within the Technostress Literature

A substantial body of recent research conceptualises technostress among university students as a predominantly negative or "dark" phenomenon associated with anxiety, reduced engagement and impaired academic functioning. Studies situated in Technology-Enhanced Learning (TEL) consistently reinforce this perspective. For example, [11] identify rapid technological changes, unstable learning platforms and continuous adaptation demands as primary triggers of cognitive strain that hinder learning effectiveness. At a broader level, [12] shows that technology-driven emergency remote learning during the pandemic heightened digital fatigue and academic disorientation as students struggled with fluctuating platform requirements. Similarly, [4] report that technological complexity and unclear digital learning structures significantly increase cognitive load and reduce learning accuracy.

More generally, post-pandemic technostress literature highlights the detrimental effects of techno-overload, techno-invasion and techno-complexity on online learning quality, satisfaction and academic outcomes [2], [5]. Recent findings even suggest that technological unpredictability can trigger online learning fatigue and reduce students' consistency in academic engagement. However, the present study advances a contrasting argument: the most salient and impactful form of technostress for postgraduate accounting students is techno-uncertainty stress arising from shifting interfaces, system updates and the unstable behaviour of digital learning technologies. Distinct from other technostress dimensions, techno-uncertainty acts as an *adaptive pressure* that encourages students to refine their study strategies and expand their technological capabilities.

Within this context, the findings of the present study contribute to the emerging body of scholarship on the "bright side" of technostress, often referred to as *techno-eustress*. [7] contend that technology-related demands can operate as challenge stressors when individuals possess adequate appraisal resources. The results of this study support this reasoning: techno-uncertainty is positively associated with performance when perceived self-efficacy the central component of coping appraisal is high, indicating that students interpret technological unpredictability as a manageable challenge that warrants additional cognitive and behavioural investment.

Moreover, this study extends TEL scholarship by highlighting the importance of cognitive appraisal in technology-mediated learning. While prior TEL studies [3], [13] emphasise the detrimental influence of digital stressors, the present findings demonstrate that when coping appraisal is strong, techno-uncertainty ceases to be a barrier and instead becomes a psychological resource that enhances both contextual and task performance among postgraduate accounting students. Accordingly, this study introduces a refined perspective into the technostress literature: technological uncertainty can lead to distinctly positive academic outcomes, particularly for learners who possess strong evaluative and adaptive capacities in responding to digital demands.

### 5.2 Theoretical Foundations Supporting the Study

#### 5.2.1 Protection Motivation Theory (PMT)

PMT is highly relevant for understanding how accounting students, particularly those accustomed to using Accounting Information Systems (AIS) and audit technologies, evaluate digital risks and respond to technological uncertainty in learning environments. In contemporary accounting contexts, students regularly interact with accounting software, ERP systems, cloud-based platforms, and data security as well as internal control procedures, all of which expose them to varying levels of technological complexity and instability.

PMT posits that protective behavioural intentions arise from two core cognitive processes: threat appraisal and coping appraisal [14]. Within the AIS environment, threat appraisal may manifest in students' perceptions of risks such as data input errors, cybersecurity threats, system instability, or vulnerabilities in financial information. Coping appraisal,

in contrast, reflects their confidence in using systems correctly, applying internal control mechanisms, and troubleshooting when disruptions occur. These processes are particularly salient in accounting education, where accurate data handling and system reliability are central to both academic and professional performance.

Prior research in accounting information systems demonstrates that individuals with strong coping appraisal are better equipped to manage system-related risks, perform data verification procedures with greater accuracy, and adapt to technological change [15], [16]. These findings are consistent with the results of the present study, which show that techno-uncertainty can enhance student performance by activating coping mechanisms grounded in their knowledge of information systems. Rather than inhibiting functioning, uncertainty prompts students to engage more deeply with system features, maintain vigilance, and apply problem-solving strategies—behaviours that are especially valuable in AIS-based learning.

This pattern is further reinforced in the broader technology-enhanced learning literature, where students facing technological uncertainty or system instability are found to engage in appraisal processes that shape their behavioural responses [3], [8]. When coping appraisal is high, they tend to interpret such challenges as manageable and even beneficial, thereby promoting adaptive performance outcomes. This theoretical logic aligns closely with the empirical results of the present study, in which techno-uncertainty improved both task and contextual performance through elevated coping appraisal.

From this perspective, PMT offers a useful explanatory lens for understanding how technostress—particularly uncertainty-driven stress—can function not only as a hindrance but also as a source of positive adaptation in technology-enhanced accounting learning environments. When combined with insights from AIS research and digital learning scholarship, the theory helps explain why technological instability may encourage students to develop stronger competencies, engage more deeply with learning tasks, and adopt more resilient learning behaviors.

**5.2.2 U-Shape Theory of Stress and Performance**

The classic U-shape model proposed by Yerkes and Dodson asserts that performance increases as stress rises until it reaches an optimal point, after which additional stress diminishes performance. This framework has been widely applied in digital academic settings to explain fluctuations in cognitive load, emotional strain, and learning outcomes, particularly during the COVID-19 period when the abrupt transition to remote learning significantly intensified technological demands [2]. In the accounting discipline, the shift to online delivery required students to work extensively with Accounting Information Systems (AIS), ERP simulations, digital audit tools, and cloud-based accounting platforms, all of which amplified the cognitive and technical demands placed upon them.

However, growing empirical evidence indicates that the stress–performance relationship is more complex than the traditional model suggests. Recent studies distinguish between challenge stressors, which stimulate constructive effort, problem solving, and focused engagement, and hindrance stressors, which obstruct progress and impair performance [17]. In higher education contexts particularly during COVID-19 technological demands such as system instability, platform uncertainty, or unpredictable interface changes often acted as challenge techno-stressors, prompting students to enhance their digital literacy, increase attentional control, and refine data verification routines [9], [10].

The findings of the present study directly support this emerging perspective. Contrary to the expected downturn in performance predicted by the U-shape curve, techno-uncertainty maintained a positive association with both task and contextual performance, provided that students demonstrated high levels of coping appraisal. This pattern mirrors evidence from COVID-19-era studies showing that students who possessed adequate psychological resources such as system knowledge, self-regulation capabilities, and adaptive coping strategies were able to reinterpret technostress not as a hindrance but as a *challenge* that motivated deeper engagement and more accurate system interaction [9], [17].

This deviation from the classical curve carries an important theoretical implication: the declining segment of the U-curve can be delayed or mitigated when individuals have sufficient cognitive and emotional resources. In this sense, coping appraisal operates as a critical moderating mechanism that transforms high technostress into *techno-eustress* a form of constructive stress that enhances analytical precision, strengthens AIS interaction skills, and promotes performance gains even under heightened digital uncertainty [2]. This explanation is particularly appropriate for the pandemic context from which this study's data were collected, as COVID-19 itself acted as a macro-level stressor that pushed students into rapid digital adaptation, making challenge-based technostress patterns more likely to emerge.

**5.2.3 Attentional Control Theory and Technology-Induced Cognitive Demands**

Attentional Control Theory (ACT), proposed by [6], posits that stressful conditions tend to deplete cognitive resources and hinder individuals' ability to regulate their attentional processes. As stress levels increase, the capacity to maintain focus on cognitively demanding tasks decreases. Research in technology-enhanced learning (TEL) has consistently supported these predictions, demonstrating that digital overload, persistent system notifications, and unstable learning

platforms can disrupt attentional control and elevate user anxiety [12], [18]. These findings are particularly relevant for accounting students who routinely engage with Accounting Information Systems (AIS), ERP modules, and digital audit tools, contexts that demand sustained concentration, high levels of accuracy, and rigorous attention to data integrity.

However, the findings of this study reveal a pattern that diverges from classical interpretations of ACT. Rather than diminishing students' attentional capacity, techno-uncertainty was found to enhance performance when coping appraisal was sufficiently high. Digital uncertainty arising from ERP module changes, accounting software errors, or system inconsistencies appears to trigger heightened vigilance, a cognitive alertness that encourages students to engage in more deliberate planning, stricter time management, and deeper attentional investment in core tasks such as data verification, account reconciliation, and internal control testing.

These results align with recent TEL literature suggesting that learners can activate compensatory cognitive strategies in response to technological stressors. [19] for example, found that students operating in digitally unstable environments can increase attentional control through additional effort, thereby maintaining or even improving—their academic performance. Similarly, [11] demonstrated that digital uncertainty is not inherently detrimental; under certain conditions, it can foster intensified cognitive engagement.

Within the context of this study, these mechanisms become clearer when integrated with the two preceding theories. Protection Motivation Theory (PMT) explains why students with strong coping appraisal do not perceive digital uncertainty as a threat, but rather as a manageable challenge. U-Shape Theory, in turn, clarifies how certain stressors when interpreted as challenge stressors can mobilize effort and focus, ultimately enhancing performance. ACT then elucidates the underlying cognitive mechanism: performance improves not because stress disappears, but because students are able to reallocate and regulate their attentional resources more adaptively.

Taken together, the findings extend the application of Attentional Control Theory within accounting and information systems education by demonstrating that attentional impairment is not an inevitable consequence of technostress. Instead, attentional resources can be strengthened when digital pressure is managed through high coping appraisal particularly in academic environments that require analytical precision and deep system comprehension. Within the context of an increasingly complex and evolving AIS environment, these insights indicate that technological uncertainty can contribute to stronger attentional control and improved academic performance, particularly when students have sufficient cognitive resources and effective coping strategies.

**5.2.4 Technology-Enhanced Learning (TEL) as the Contextual Anchor**

Technology-Enhanced Learning (TEL) provides the overarching pedagogical and technological environment within which this study is embedded. The rapid expansion of digital learning platforms, online assessment systems, cloud-based accounting tools, and remote collaboration technologies during the COVID-19 period significantly transformed students' engagement with digital systems. Prior TEL literature emphasises that such environments simultaneously create opportunities and risks: they improve flexibility and access, but also intensify technological demands, interface instability, and cognitive load [1], [10], [19]. For accounting students working with AIS, ERP simulations, and audit analytics tools, such volatility has direct implications for accuracy, attention, and system navigation.

The findings of this study reinforce the emerging consensus that TEL environments are inherently dynamic and require ongoing adjustment of cognitive and emotional resources. Notably, techno-uncertainty was identified as the most influential technostress dimension shaping student performance. This form of technostress, driven by system updates, unpredictable interface changes, software errors, and inconsistent digital infrastructure has been recognised in recent TEL research as a critical but underexplored driver of student stress [18], [20]. While techno-uncertainty is typically associated with heightened cognitive strain, the present study demonstrates that its effects become adaptive rather than harmful when students possess strong perceived self-efficacy, a key component of coping appraisal.

Perceived self-efficacy strengthens students' confidence in their ability to troubleshoot system issues, maintain accuracy under shifting technological conditions, and adapt to unanticipated digital disruptions. This aligns with evidence from studies in TEL and information systems showing that self-efficacy mitigates the negative effects of technostress and enhances digital performance [9]. Within AIS-based learning, self-efficacy acts as a psychological resource that transforms techno-uncertainty into a challenge stressor, prompting greater attentional allocation, problem-solving engagement, and persistence—mechanisms consistent with challenge–hindrance frameworks in educational technology [17].

By demonstrating that techno-uncertainty can foster improved academic outcomes under conditions of high perceived self-efficacy, this study advances TEL scholarship in several ways. First, it identifies the specific interaction mechanism between techno-uncertainty and self-efficacy as a pathway through which technological instability becomes beneficial. Second, it contributes to a growing body of work suggesting that technological volatility can heighten cognitive engagement rather than impair it when learners feel competent and digitally capable [11], [19].

Third, it highlights the need to cultivate digital confidence and system-handling skills among accounting students who operate within highly dynamic AIS environments.
From this standpoint, Technology-Enhanced Learning (TEL) provides the broader context for understanding why techno-uncertainty often viewed as detrimental, can instead be associated with improved performance when accompanied by strong perceived self-efficacy. This interaction helps explain how technostress operates within contemporary learning environments and why, in this study, technological instability was associated with more positive academic outcomes.

**5.3 Why These Findings Matter Now**

Although the data for this study were collected during the acute phase of COVID-19, the implications extend far beyond the pandemic era. Recent evidence in higher education demonstrates that online, hybrid and technology-intensive instructional models have become permanent features of university curricula [12], [19]. Simultaneously, emerging reviews caution that technostress is likely to intensify as learning environments incorporate AI-supported tools, data analytics platforms and increasingly interconnected digital systems [18]. Understanding how students previously adapted to rapid, large-scale digital transitions is therefore essential for informing support structures in this new, more technologically saturated phase.
This study is particularly important because it reveals a case in which technostress specifically techno-uncertainty did not undermine well-being or performance, as widely reported in earlier research [5], [20]. Instead, technostress acted as a catalyst for adaptive coping and enhanced academic outcomes when students possessed strong perceived self-efficacy. This challenges the traditional assumption that technostress is inherently harmful and highlights that its consequences depend on the dynamic interplay between technological demands and students' coping appraisal.
In line with contemporary findings that crisis conditions can stimulate more supportive and resilient learning designs [1], [21], the results of this study suggest that techno-uncertainty can be leveraged constructively particularly in professional programmes such as accounting when curricula and institutional policies intentionally cultivate students' coping capabilities. For accounting education, where mastery of AIS, ERP systems and digital audit technologies is essential, such adaptive responses are highly relevant to both academic and future professional performance.
From a practical perspective, the findings point to the importance of universities providing more structured support to strengthen students' coping appraisal, particularly their perceived self-efficacy. Such support may take the form of digital self-regulation training, gradual and scaffolded exposure to complex technologies, peer-based support mechanisms, and responsive learning-technology assistance. When such resources are made available, technostress stemming from ongoing digital transformation is more likely to manifest as *techno-eustress* a productive form of stress that enhances, rather than inhibits, students' learning engagement and readiness for technology-intensive accounting professions.

**5.4. Managerial and Social Implications**

The findings of this study yield important managerial and social implications for higher education institutions that increasingly rely on Technology-Enhanced Learning (TEL), particularly in accounting programs where the use of Accounting Information Systems (AIS), ERP modules, and digital audit tools has become integral. Given that techno-uncertainty emerged as the most salient technostress dimension and perceived self-efficacy as the key coping appraisal component shaping adaptive responses, institutional strategies must prioritise the enhancement of users' digital confidence and resilience.

In line with the Technology-Enhanced Learning (TEL) framework, technological volatility such as frequent AIS updates, changes in ERP interfaces, or platform instability can interrupt learning continuity and reduce the quality of social and pedagogical interaction in online settings. For this reason, institutions need to pay greater attention to stabilizing digital infrastructures and developing communication practices that help sustain meaningful human interaction, even within technology-mediated learning environments.

From the perspective of Protection Motivation Theory (PMT), strengthening perceived self-efficacy plays an important role in how both instructors and students respond to techno-uncertainty. Support in the form of digital competency development, troubleshooting training, and accessible technical assistance can help individuals interpret technological uncertainty as a manageable challenge rather than a threat. This distinction is particularly important in AIS-based courses, where unexpected system changes often introduce additional cognitive demands.

In line with the U-Shape Theory, techno-uncertainty may operate as a challenge stressor that supports performance when technological demands remain stimulating rather than overwhelming. This perspective suggests that institutional

policies need to strike a balance by limiting excessive technological complexity while still providing sufficient challenge to encourage the development of digital problem-solving skills.

From the perspective of Attentional Control Theory (ACT), technology-induced stress is likely to impair performance primarily when individuals struggle to regulate their attentional resources. When perceived self-efficacy is high, however, individuals tend to reallocate attention more effectively under conditions of digital uncertainty, allowing them to maintain concentration, remain vigilant, and perform tasks more consistently. This suggests the importance of providing clear instructional scaffolding, structured system guidelines, and appropriate cognitive support to help users sustain attentional control in technologically unstable learning environments.

Taken from a broader perspective, these implications point to the importance of how higher education institutions approach techno-uncertainty. Strengthening perceived self-efficacy, maintaining stable TEL environments, and supporting attentive engagement with digital systems appear to be key elements in this process. When these conditions are in place, technology-related stressors are more likely to support improved performance rather than hinder effective learning and teaching.

## 6. Conclusion, Limitations, and Directions for Future Research

### 6.1 Conclusion

This study contributes to a deeper understanding of how accounting students respond to technology-induced demands within Technology-Enhanced Learning (TEL) environments and Accounting Information Systems (AIS). Based on the validity and reliability assessments, the analysis focused on techno-uncertainty and perceived self-efficacy as the constructs that demonstrated sufficient empirical robustness within the measurement model.

The results indicate that techno-uncertainty reflected in system volatility, software errors, and unpredictable digital transitions can be associated with higher levels of both task and contextual performance when students report strong perceived self-efficacy. In this context, perceived self-efficacy appears to play a key role in shaping how students interpret and respond to technological unpredictability, allowing them to view such conditions as manageable and motivating rather than disruptive. This dynamic is consistent with Protection Motivation Theory (PMT), which emphasises the decisive role of self-efficacy in adaptive behavioural responses.

The results also align with the U-Shape Theory by showing that stressors interpreted as challenges can generate performance-enhancing effects. Attentional Control Theory (ACT) helps explain why individuals with strong self-efficacy are better able to redirect their attentional resources when facing technological instability. Viewed within the broader Technology-Enhanced Learning (TEL) context, the findings suggest that techno-uncertainty often regarded as detrimental may instead operate as a form of techno-eustress that encourages productive cognitive engagement and supports academic performance.

Taken together, the results highlight the central role of perceived self-efficacy in enabling students to adapt and perform effectively within technology-intensive accounting education. Strengthening digital self-efficacy should therefore be prioritised as a strategic pedagogical objective in modern AIS-oriented curricula. From a practical perspective, the findings inform universities and accounting programmes on how techno-uncertainty can be managed as a productive learning stimulus through targeted institutional support and the development of students' digital self-efficacy.

### 6.2 Limitations

Several limitations should be acknowledged to contextualise these findings:

a. **Measurement Model Constraints**
   Only techno-uncertainty and perceived self-efficacy met the validity and reliability criteria. This methodological constraint not a theoretical limitation shaped the scope of the analysis.
b. **Pandemic-Specific Context**
   Data were collected during the COVID-19 emergency period, which may have amplified technological pressures and accelerated adaptation processes. Post-pandemic learning environments may produce different patterns of response.
c. **Sample Composition**

The study focuses on accounting students who regularly engage with AIS and digital audit tools, which may limit the applicability of the findings to disciplines with lower technological intensity.

**d. Cross-Sectional Data Design**
This study is based on data collected at a single point in time. Given that responses to technostress are likely to evolve, future research using longitudinal designs could offer a more detailed understanding of how such adaptation develops over time.

**6.3 Directions for Future Research**

Building on the limitations and findings of this study, several directions for future research can be identified. First, future studies may extend the cognitive appraisal framework by incorporating additional dimensions, such as response efficacy, digital resilience, or self-regulated learning, to develop a more comprehensive understanding of coping appraisal under conditions of technostress.

Further research may also examine potential moderating and mediating factors that shape the relationship between techno-uncertainty and academic performance. Variables such as AIS proficiency, digital literacy, task complexity, institutional support, and individual motivation are likely to influence how students respond to technological uncertainty.

In addition, longitudinal research designs would be valuable for exploring how perceived self-efficacy evolves as students repeatedly encounter technological change within AIS-based learning environments. Such approaches could provide deeper insight into the dynamic nature of adaptation to technostress over time.

Experimental studies focusing on instructional design may also offer important contributions. For example, research on scaffolded exposure to digital complexity, structured troubleshooting training, or guided AIS simulations could help clarify the causal mechanisms through which techno-uncertainty develops into techno-eustress.

Finally, comparative research across disciplines and institutions could assess whether the positive effects of techno-uncertainty observed in accounting education extend to other academic fields or learning contexts with different levels of technological intensity.

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