JURNAL UPI

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Journal Homepage: http://ejournal.upi.edu/index.php/JPKI

JPKI

Academic Stress, Digital Distraction, and Academic Procrastination in Generation Z Nursing Students: A Longitudinal Study of the Protective Role of Resilience

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A B S T R A C T

Introduction: Generation Z nursing students face substantial academic demands alongside continuous smartphone engagement, which may be associated with digital distraction and academic procrastination. Although associations between academic stress and procrastination have been reported, the longitudinal role of problematic smartphone use as an indicator of digital distraction and the buffering role of resilience remain underexplored. **Objective:** This study examined longitudinal associations among academic stress, digital distraction operationalized through problematic smartphone use, and academic procrastination in Generation Z nursing students and explored resilience as a protective factor. **Methods:** A three-wave longitudinal survey was conducted among undergraduate nursing students in West Java, Indonesia. Measures included PSS-10, Smartphone Application-Based Addiction Scale (SABAS), PASS, and CD-RISC-10 at baseline, 4 weeks, and 8 weeks. Of 368 participants, 342 completed all waves (retention 92.9%; mean age 20.34 ± 1.71 years; 79.5% female). Data were analyzed using structural equation modeling with cross-lagged panel and moderation analysis. **Results:** At baseline, academic stress was positively associated with digital distraction ($r = .41$, $p < .001$) and procrastination ($r = .46$, $p < .001$), while digital distraction was associated with procrastination ($r = .49$, $p < .001$). Resilience was negatively associated with stress ($r = -.38$, $p < .001$) and procrastination ($r = -.34$, $p < .001$). Model fit was acceptable (CFI = .93–.94, TLI = .92–.93, RMSEA = .047–.049, SRMR = .041–.043). Higher academic stress was associated with subsequent digital distraction ($\beta = .32$, $p < .001$) and procrastination ($\beta = .21$, $p = .004$). Indirect associations were significant ($\beta = .12$, 95% CI [.07, .18]). Resilience was associated with lower procrastination ($\beta = -.24$, $p < .001$) and moderated the stress–procrastination association ($\beta = -.18$, $p = .002$). **Conclusion**: Academic stress was longitudinally associated with academic procrastination, directly and through digital distraction operationalized as problematic smartphone use. Higher resilience was associated with lower procrastination and a weaker stress–procrastination association.

ARTICLE INFO

Article History:

Received: March 05th, 2026
Revised: June 28th, 2026
Accepted: June 30th, 2026
First Available Online: June 30th, 2026
Published: June 30th, 2026

Keywords:
Stress, Psychological, academic procrastination, digital distraction, Generational Groups, Students, Nursing, Longitudinal Studies.

1. INTRODUCTION

Academic life in higher education often exposes students to various psychological and academic demands that may influence their learning behaviors and academic performance. Among these challenges, academic stress is one of the most frequently reported stressors experienced by university students. Academic stress arises from heavy coursework, performance expectations, examinations, and time pressure associated with academic tasks. Nursing students may experience even higher levels of academic stress due to the complexity of theoretical learning combined with clinical practice requirements and professional expectations (Mustofa et al., 2023; Kohli et al., 2024). Previous studies have shown that prolonged academic stress can negatively influence students' learning motivation, mental well-being, and academic functioning (Obenza et al., 2023).

One academic behavior closely associated with academic stress is academic procrastination, defined as the intentional delay of academic tasks despite awareness of potential negative consequences. Academic procrastination is a common phenomenon among university students and has been associated with poor academic outcomes, increased anxiety, and reduced life satisfaction. Research among nursing students indicates that procrastination behaviors can significantly affect academic performance and overall well-being (Demir & Kuşcu Karatepe, 2025; Rahmani et al., 2025). Furthermore, procrastination within the nursing education context has been recognized as a behavioral pattern that can hinder academic progress and professional preparation, particularly when students are faced with complex academic responsibilities (Zhang et al., 2025).

In the digital era, academic behavior among students is also influenced by digital technology use, particularly smartphones and internet-based platforms. Generation Z students, who have grown up in highly digitalized environments, are frequently exposed to continuous online interactions that may disrupt their academic concentration. While digital technologies provide important educational benefits, excessive digital engagement may lead to digital distraction, which can interfere with students' ability to complete academic tasks efficiently. Studies have shown that problematic smartphone use and internet addiction are significantly associated with increased academic procrastination among students (Wu et al., 2025; Zhao et al., 2025). A meta-analysis examining the relationship between smartphone addiction and procrastination confirmed a consistent positive association between excessive smartphone use and delayed academic task completion (Zhou et al., 2024).

Several mechanisms may explain how digital distraction contributes to procrastination behaviors. Digital platforms often provide immediate gratification through entertainment, social interaction, and continuous information updates, which may compete with students' academic priorities. Empirical research suggests that problematic smartphone use can impair self-regulation and increase the likelihood of procrastination behaviors in academic contexts (Akinci, 2021; Liu et al., 2020). Similarly, studies among university students and healthcare professionals indicate that smartphone addiction may lead to reduced productivity and increased tendencies to delay work-related tasks (El-Sayed et al., 2024; Xue et al., 2024). Among nursing students, problematic mobile phone use has also been shown to contribute to higher levels of academic procrastination (El-Ghannam & Abd El-Hamid, 2023).

Despite the increasing evidence linking digital technology use to procrastination, individual psychological resources may influence how students cope with academic and digital challenges.

DOI: https://doi.org/10.17509/jpki.v12i1.97900
e-ISSN 2477-3743 | p-ISSN 2541-0024

One important protective factor is resilience, defined as the ability to adapt effectively to stress, adversity, and challenging situations. In academic settings, resilience helps students maintain motivation, persistence, and emotional stability when facing academic pressures. Research among nursing students has shown that resilience is associated with better academic adjustment and lower levels of maladaptive academic behaviors (Rahmani et al., 2025). Furthermore, resilience may play an important role in buffering the negative effects of digital stress and academic pressures on students' behavioral outcomes (An et al., 2025).

The proposed relationships in this study are informed by several complementary theoretical perspectives. First, the Stress–Coping Framework suggests that individuals experiencing stress may engage in avoidance-oriented coping behaviors to reduce emotional discomfort when coping resources are insufficient. Within academic settings, students experiencing academic stress may temporarily shift attention away from demanding tasks toward more immediately rewarding activities, including smartphone use and online engagement. Second, Self-Regulation Theory proposes that successful academic functioning depends on the ability to regulate attention, emotions, and goal-directed behaviors. Under conditions of elevated stress, students' self-regulatory capacity may become depleted, increasing vulnerability to digital distraction and reducing persistence in completing academic tasks. Third, Temporal Motivation Theory explains procrastination as the result of choosing activities that provide immediate rewards over tasks with delayed outcomes. Digital environments, which offer rapid gratification through social interaction and entertainment, may become particularly attractive under stressful conditions and contribute to delayed academic task completion. Within this conceptual framework, resilience may function as a protective psychological resource that supports adaptive coping and self-regulation, thereby weakening the association between academic stress and procrastination and reducing susceptibility to digital distraction.

Recent studies also suggest that resilience may interact with digital behaviors and self-regulation processes in shaping academic outcomes. For example, research on smartphone addiction and academic procrastination has demonstrated that psychological resilience and self-regulation can mediate the relationship between digital technology use and procrastination behaviors (Liu et al., 2026). These findings indicate that students with higher resilience may be better able to regulate digital distractions and maintain focus on academic tasks despite experiencing academic stress. Although previous research has examined academic stress, digital technology use, and academic procrastination separately, several important gaps remain in the literature. First, many studies have focused on bivariate relationships, such as stress and procrastination or smartphone addiction and procrastination, without examining the broader interaction among academic stress, digital distraction, and procrastination within a single framework (Wu et al., 2025; Zhao et al., 2025). Second, while the role of resilience in academic functioning has been explored, limited studies have examined resilience as a protective factor within the pathway linking academic stress, digital distraction, and procrastination, particularly among nursing students. Third, much of the existing research on digital distraction and procrastination has been conducted among general university populations rather than within the context of professional health education programs (Zhang et al., 2025).

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e-ISSN 2477-3743 | p-ISSN 2541-0024

Understanding these relationships is particularly important for nursing education, as nursing students are expected to manage demanding academic workloads while developing professional competencies required for clinical practice. Academic procrastination and digital distraction may negatively affect students' academic progress, learning engagement, and professional development. Therefore, identifying protective psychological resources such as resilience may help educators design strategies to support students' academic success and well-being. Therefore, this study aims to examine the relationships among academic stress, digital distraction, and academic procrastination among Generation Z nursing students, with a particular focus on the protective role of resilience. By integrating the Stress–Coping Framework, Self-Regulation Theory, and Temporal Motivation Theory with emerging research on digital behaviors, this study seeks to provide a theoretically informed understanding of the pathways linking academic stress, digital distraction, and academic procrastination and the potential protective role of resilience in contemporary nursing education contexts.

2. METHODS

Study Design

This study employed a longitudinal survey design to examine the relationships among academic stress, digital distraction, academic procrastination, and resilience among Generation Z nursing students. A longitudinal approach was selected because cross-sectional designs are limited in their ability to examine temporal relationships among behavioral and psychological constructs. Longitudinal modeling allows researchers to observe patterns of change over time and evaluate directional relationships among variables through repeated measurement (Mackinnon et al., 2022). Data were collected at three time points across an academic semester to capture changes in students' stress levels, digital engagement, and procrastination behaviors during the learning process.

Sample

Participants were undergraduate nursing students enrolled in a Bachelor of Nursing program at a university in West Java, Indonesia. Institutional identity is not reported to preserve confidentiality. The study focused on Generation Z students, defined as individuals born between approximately 1997 and 2012, which corresponds to the typical age range of current university students. Participants were eligible if they were actively enrolled in the nursing program, aged between 18 and 26 years, regularly used a smartphone and internet-based applications, were able to understand Bahasa Indonesia, and provided informed consent to participate in the study. Students were excluded if they were on academic leave during the data collection period, had incomplete baseline responses, or reported severe psychological conditions that could interfere with participation in survey research.

Eligible students were grouped by year of study and invitations were distributed proportionally sampling to ensure representation across different academic year levels. Students were grouped according to their year of study and invitations were distributed proportionally to reflect the student population structure in the participating institutions.

Sample size estimation was conducted using G*Power statistical software. The calculation was based on multiple regression parameters corresponding to the most complex model tested in

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e-ISSN 2477-3743 | p-ISSN 2541-0024

the study. Following recommendations for behavioral research, the analysis assumed a small-to-moderate effect size ($f^2 = 0.05$), an alpha level of 0.05, statistical power of 0.90, and approximately ten predictors including covariates. Under these parameters, the minimum required sample size was approximately 260–280 participants. Considering the possibility of attrition across the three measurement waves, an initial recruitment target of at least 350 participants was determined to ensure sufficient statistical power for the final longitudinal analysis (Kang, 2021).

Instruments

Academic stress was measured using the Perceived Stress Scale – 10 items (PSS-10). The instrument was originally developed to measure perceived stress and has been widely applied in studies involving university students. The scale consists of ten items rated on a five-point Likert scale ranging from 0 (never) to 4 (very often). Items measure the degree to which individuals perceive situations in their lives as stressful during the previous month. After reverse scoring of positively worded items, all items are summed to obtain a total stress score, with higher scores indicating greater perceived stress. The Indonesian version of the PSS-10 demonstrated acceptable psychometric properties and factorial validity, fitting a two-factor structure (perceived helplessness and perceived self-efficacy). Among student participants, the instrument showed composite reliability (CR) of 0.81 and average variance extracted (AVE) of 0.38 (Hakim et al., 2024).

Digital distraction was measured using the Smartphone Application-Based Addiction Scale (SABAS). Although SABAS was originally developed to assess problematic engagement with smartphone applications rather than digital distraction directly, this instrument was selected because problematic smartphone use represents a behavioral manifestation of persistent digital engagement that may interfere with attention regulation and academic task performance. In the context of this study, digital distraction was operationalized as difficulty maintaining academic focus due to excessive or uncontrolled smartphone application use. Therefore, SABAS was used as a proxy indicator of digital distraction rather than a direct measure of distraction itself. The instrument consists of six Likert-type items, with higher scores indicating greater problematic smartphone engagement. The Indonesian version of SABAS has demonstrated acceptable reliability and validity among university students, with reported Cronbach's alpha of approximately .74 and McDonald's omega of .79 (Nurmala et al., 2022).

Academic procrastination was assessed using the Procrastination Assessment Scale–Students (PASS). This instrument is widely used to measure procrastination in academic contexts. The scale evaluates both the frequency of procrastination in specific academic tasks and the reasons underlying procrastination behavior. Participants rate items using a Likert-type scale reflecting the extent to which they delay academic tasks. Higher scores indicate higher levels of academic procrastination. The Indonesian adaptation of the PASS has undergone validation procedures including confirmatory factor analysis and has demonstrated satisfactory reliability and construct validity (Hidayah, 2023).

Resilience was measured using the Connor–Davidson Resilience Scale – 10 items (CD-RISC-10). The scale assesses individuals' capacity to adapt to stress and adversity. Participants respond to ten items using a Likert scale reflecting how frequently each statement applies to them. Total scores range from low to high resilience, with higher scores indicating greater psychological

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e-ISSN 2477-3743 | p-ISSN 2541-0024

resilience. The Indonesian validation of the CD-RISC-10 has reported strong reliability, with Cronbach's alpha values around .87, supporting its use for measuring resilience in Indonesian populations (Gina & Fitriani, 2022).

In addition to the main constructs, demographic and academic variables were collected at baseline to control for potential confounding factors. These variables included age, gender, year of study, grade point average, average daily screen time, and perceived academic workload.

Procedure

This study received ethical approval from the Institutional Review Board of the participating university (Approval No. IIII/111/KEPK/STIKep/PPNI/Jabar/V/2025) before data collection commenced. Following approval, permission was obtained from faculty administrators to distribute study invitations through official communication channels, including student mailing lists and learning management systems.

Before the main study was conducted, a pilot test involving approximately 20–30 nursing students was carried out to evaluate clarity of survey items, questionnaire length, and technical functionality of the online data collection platform. Feedback from pilot participants was used to refine the wording of instructions and ensure that all items were clearly understood without altering the structure of validated instruments.

Eligible students who received the study invitation accessed an online information sheet explaining the study purpose, procedures, confidentiality assurances, and voluntary participation. Students who agreed to participate provided electronic informed consent prior to completing the questionnaire.

Data were collected across three waves. At the first time point (T1), participants completed demographic questions and all study instruments. At the second time point (T2), approximately four weeks after baseline, participants completed the same psychological measures again. The third wave (T3) was conducted eight weeks after baseline and included the same instruments together with additional brief questions allowing participants to provide feedback regarding their experience completing the survey and their perceptions of digital distraction during academic activities. Participants' responses were anonymized using unique identification codes to ensure confidentiality and to enable matching responses across the three time points.

Data analysis

Data analysis was conducted using structural equation modeling techniques to evaluate the relationships among academic stress, digital distraction, academic procrastination, and resilience. Preliminary analyses included descriptive statistics, assessment of missing data patterns, and examination of normality assumptions. Missing data were handled using full information maximum likelihood estimation when appropriate. The measurement model was first tested using confirmatory factor analysis to ensure that each construct demonstrated acceptable factorial validity within the sample. The measurement model was first tested using confirmatory factor analysis to evaluate factorial validity of the study constructs. After establishing acceptable model fit, cross-lagged panel modeling was applied to examine temporal associations among academic stress, digital distraction, and academic procrastination across the three measurement waves. After establishing measurement

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e-ISSN 2477-3743 | p-ISSN 2541-0024

invariance, cross-lagged panel modeling was applied to examine temporal relationships among academic stress, digital distraction, and academic procrastination. This approach allowed the estimation of both autoregressive effects and cross-lagged paths between variables across measurement waves. Indirect effects were tested to determine whether digital distraction mediated the relationship between academic stress and academic procrastination. Resilience was examined as a protective factor within the model using moderation analysis. Moderation effects were tested using latent interaction modeling or multigroup structural equation modeling comparing students with lower and higher resilience levels. Model fit was evaluated using standard structural equation modeling indices including the Comparative Fit Index, Tucker–Lewis Index, Root Mean Square Error of Approximation, and Standardized Root Mean Square Residual. Bootstrapping procedures with 5,000 resamples were used to estimate confidence intervals for indirect effects.

Ethical Considerations

This study received ethical approval from the Institutional Review Board of the participating university (Approval No. IIII/111/KEPK/STIKep/PPNI/Jabar/V/2025).

3. RESULT

Participant Characteristics

A total of 368 nursing students initially participated in the baseline survey (T1). After excluding incomplete responses and accounting for attrition across the three measurement waves, 342 participants completed all three waves of data collection and were included in the final longitudinal analysis, resulting in a retention rate of 92.9%. The mean age of participants was 20.34 years (SD = 1.71), ranging from 18 to 26 years. The majority of participants were female, which reflects the gender distribution typically observed in nursing education programs. Table 1 presents the demographic and academic characteristics of the participants at baseline. Most students were in their second and third years of study. The average cumulative grade point average (GPA) was relatively high, reflecting good academic standing. Participants reported substantial daily screen time, with more than half indicating that they spent over five hours per day using smartphones or digital devices. This pattern highlights the high level of digital engagement among Generation Z nursing students.

Table 1. Demographic Characteristics of Participants (N = 342)

Variable	Category	n	%
Gender	Female	272	79.5
	Male	70	20.5
Age	18–20 years	148	43.3
	21–23 years	162	47.4
	24–26 years	32	9.3
Year of Study	Year 1	78	22.8
	Year 2	112	32.7
	Year 3	96	28.1
	Year 4	56	16.4
GPA	< 3.00	64	18.7
	3.00–3.49	158	46.2
	≥ 3.50	120	35.1
Daily Screen Time	< 3 hours	46	13.5
	3–5 hours	122	35.7
	> 5 hours	174	50.8

DOI: https://doi.org/10.17509/jpki.v12i1.97900
e-ISSN 2477-3743 | p-ISSN 2541-0024

Descriptive Statistics of Study Variables

Descriptive statistics for the main study variables across the three measurement waves are presented in Table 2. At baseline (T1), the mean academic stress score was 18.67 (SD = 5.84), indicating moderate levels of perceived stress among participants. Digital distraction scores showed a moderate tendency toward smartphone application engagement during academic activities. Academic procrastination scores indicated a moderate tendency for delaying academic tasks. Resilience levels were relatively high among the participants, suggesting that many students possessed psychological resources that could help them cope with academic challenges. Across the semester, academic stress and digital distraction slightly increased, particularly toward the end of the academic term (T3). Academic procrastination also showed a modest upward trend, while resilience levels remained relatively stable across the three waves.

Table 2. Descriptive Statistics of Main Variables Across Three Waves (N = 342)

Variable	T1 Mean (SD)	T2 Mean (SD)	T3 Mean (SD)
Academic Stress	18.67 (5.84)	19.92 (6.03)	21.05 (6.11)
Digital Distraction	15.34 (4.12)	16.27 (4.30)	17.11 (4.46)
Academic Procrastination	43.85 (9.72)	45.10 (10.01)	46.92 (10.24)
Resilience	27.68 (6.15)	27.41 (6.09)	27.52 (6.21)

Correlation Analysis

Pearson correlation analysis was conducted to examine the relationships among academic stress, digital distraction, academic procrastination, and resilience at baseline. The results indicated that academic stress was positively correlated with digital distraction ($r = .41$, $p < .001$) and academic procrastination ($r = .46$, $p < .001$). Digital distraction also showed a significant positive correlation with academic procrastination ($r = .49$, $p < .001$). In contrast, resilience demonstrated a significant negative correlation with academic stress ($r = -.38$, $p < .001$) and academic procrastination ($r = -.34$, $p < .001$).

Table 3. Correlation Matrix of Study Variables at Baseline (T1)

Variable	1	2	3	4
Academic Stress	1			
Digital Distraction	.41***	1		
Academic Procrastination	.46***	.49***	1	
Resilience	−.38***	−.26***	−.34***	1

Note; ***p < .001

Measurement Model and Model Fit

Confirmatory factor analysis was conducted to evaluate the measurement model for the four latent constructs. The results indicated that all factor loadings were statistically significant and exceeded the recommended threshold of .50, suggesting acceptable indicator reliability. Composite reliability values ranged from .78 to .91, while average variance extracted values ranged from .52 to .68, indicating satisfactory convergent validity. The measurement model

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demonstrated good overall fit to the data. The structural equation model produced the following fit indices: Comparative Fit Index (CFI) = .94, Tucker–Lewis Index (TLI) = .93, Root Mean Square Error of Approximation (RMSEA) = .047, and Standardized Root Mean Square Residual (SRMR) = .041. These values meet commonly recommended thresholds, indicating that the measurement model adequately represents the observed data.

Longitudinal Structural Model

A cross-lagged panel model was estimated to examine the temporal relationships among academic stress, digital distraction, and academic procrastination across the three measurement waves. The structural model demonstrated good fit to the data (CFI = .93, TLI = .92, RMSEA = .049, SRMR = .043). Academic stress at T1 significantly predicted digital distraction at T2 (β = .32, $p < .001$). Digital distraction at T2 subsequently predicted academic procrastination at T3 (β = .37, $p < .001$). Academic stress also showed a direct effect on academic procrastination across waves (β = .21, $p < .01$), indicating that both direct and indirect mechanisms contribute to procrastination behavior. Bootstrapping analysis confirmed a significant indirect effect of academic stress on academic procrastination through digital distraction (β = .12, 95% CI [.07, .18]). This finding supports the mediating role of digital distraction in the relationship between academic stress and procrastination among nursing students.

Table 4. Structural Equation Model Results

Path	β	SE	p-value
Academic Stress T1 → Digital Distraction T2	.32	.05	< .001
Digital Distraction T2 → Academic Procrastination T3	.37	.06	< .001
Academic Stress T1 → Academic Procrastination T3	.21	.07	.004
Resilience → Academic Procrastination	−.24	.05	< .001

Moderating Role of Resilience

Moderation analysis was conducted to examine whether resilience buffered the impact of academic stress on academic procrastination. The results indicated that resilience significantly moderated the relationship between academic stress and procrastination (interaction $\beta = -.18$, $p = .002$). Students with higher resilience demonstrated a weaker association between academic stress and procrastination compared to students with lower resilience. Figure 1 illustrates the moderating effect of resilience. Among students with low resilience, academic stress strongly predicted higher levels of procrastination. However, among students with high resilience, the effect of academic stress on procrastination was substantially reduced.

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e-ISSN 2477-3743 | p-ISSN 2541-0024

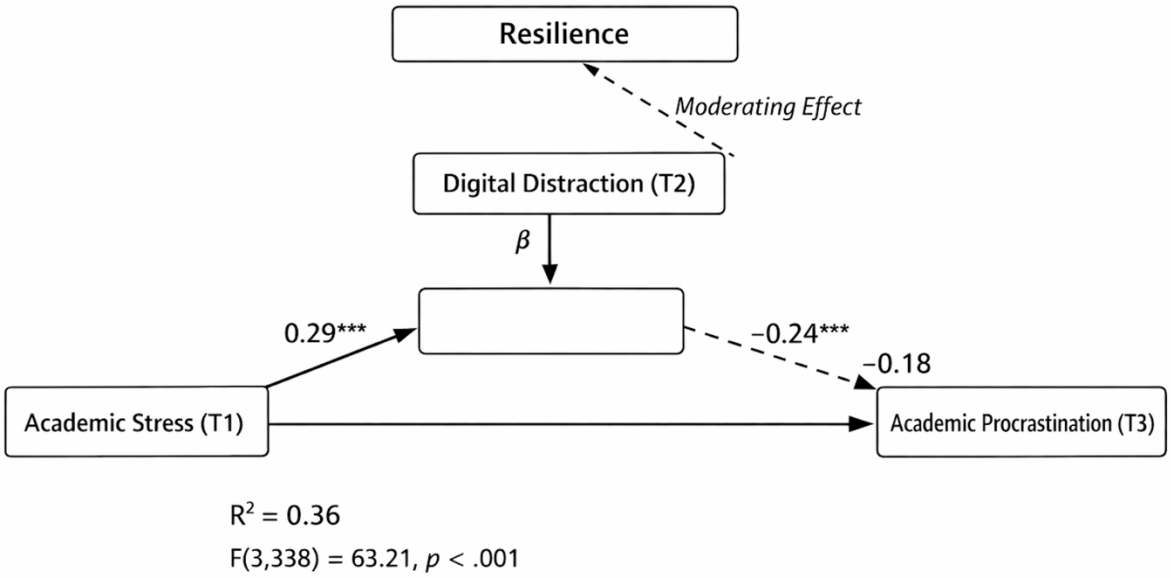

Figure 1. Structural Equation Model of Academic Stress, Digital Distraction, Academic Procrastination, and Resilience

4. DISCUSSION

This longitudinal study examined the relationships among academic stress, digital distraction, academic procrastination, and resilience among Generation Z nursing students. The findings revealed that academic stress predicted higher levels of digital distraction over time, which subsequently increased academic procrastination. Furthermore, resilience functioned as both a protective factor and a moderating variable that weakened the effect of stress on procrastination. These results provide a more comprehensive understanding of how psychological stress and digital behavioral patterns interact to influence academic behaviors among contemporary nursing students who are highly immersed in digital environments.

The results of this study demonstrate that academic stress significantly predicted academic procrastination over time. This finding supports conceptual perspectives suggesting that procrastination is often used as a coping mechanism for managing negative emotions associated with demanding academic tasks. When students experience excessive stress, they may postpone academic responsibilities to temporarily reduce emotional discomfort (Sirois, 2023). In nursing education programs, which are characterized by intensive coursework and clinical requirements, students may encounter persistent academic pressure that contributes to procrastination behavior. Previous research has similarly reported that academic stress is strongly associated with increased procrastination among students. Qualitative findings from earlier work indicate that students often delay academic tasks because they feel overwhelmed by academic expectations or fear academic failure (Grunschel et al., 2013). The present study extends these findings by demonstrating a longitudinal relationship, suggesting that academic stress does not only coexist with procrastination but may also contribute to its development over time.

Previous research conducted in China, Europe, and other international contexts has similarly reported that academic stress is associated with higher procrastination among students (Grunschel et al., 2013). However, interpretation of the present findings should consider the

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Indonesian educational and sociocultural context. Indonesian nursing education is often characterized by structured learning environments, relatively high academic expectations, and collectivist social values that may shape students' responses to academic challenges differently from those reported in more individualistic educational settings. In this context, students may not disengage completely from academic responsibilities but may instead adopt avoidance strategies that preserve social functioning while delaying task completion. Therefore, although the overall pattern observed in this study appears consistent with international evidence, the behavioral expression and underlying mechanisms of procrastination may vary across cultural contexts.

From a psychological perspective, stress may impair cognitive control processes such as planning, self-regulation, and task initiation. When these executive functions are disrupted, students may be more likely to engage in avoidance behaviors, including procrastination, particularly when faced with challenging academic activities (Sirois, 2023). This mechanism may be particularly relevant for nursing students who must balance theoretical coursework, clinical placements, and professional expectations. Another important contribution of this study is the identification of digital distraction as one potential intermediary pathway linking academic stress and academic procrastination. The results indicated that students reporting higher academic stress also tended to report higher levels of digital distraction over time, which was subsequently associated with higher academic procrastination. This finding aligns with growing evidence indicating that excessive digital engagement can interfere with students' ability to maintain attention and academic focus. Research has shown that smartphone addiction and problematic digital media use are associated with lower academic performance and increased cyberloafing behaviors among university students (Talan et al., 2023). Similarly, problematic smartphone use has been linked to emotional distress and stress among university students, suggesting that students may use digital technologies as a coping strategy in response to academic pressures (Hashemi et al., 2022).

For Indonesian Generation Z students, however, digital engagement should not be interpreted exclusively as maladaptive behavior. Digital platforms are deeply integrated into academic activities, communication patterns, and social support systems. Therefore, the observed association may reflect how students manage academic pressure within a highly connected environment rather than indicating that technology use itself leads to procrastination. Studies examining digital behaviors such as Fear of Missing Out (FoMO) indicate that continuous connectivity to social media may contribute to fragmented attention and reduced concentration during academic activities (Rozgonjuk et al., 2020).

Longitudinal evidence also suggests that procrastination and problematic internet use are closely related behavioral patterns. For instance, research has demonstrated that procrastination may predict future internet use disorders, highlighting the complex relationship between digital behaviors and delayed task completion (Lardinoix et al., 2023). The mediation results of the current study suggest that digital distraction may act as one intermediary mechanism through which academic stress is associated with procrastination behaviors. Furthermore, psychological studies indicate that deficits in self-control and excessive multi-screen engagement may increase the likelihood of procrastination by weakening students' ability to regulate digital behaviors during

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e-ISSN 2477-3743 | p-ISSN 2541-0024

academic tasks (Gökalp et al., 2023). Similarly, problematic smartphone use has been shown to mediate the relationship between self-regulatory processes and procrastination behaviors in young adults (Mao et al., 2022).

However, digital distraction should not be interpreted as the only pathway linking academic stress and procrastination. Academic procrastination is a multifactorial behavior influenced by various psychological and contextual factors. Previous studies suggest that anxiety, reduced academic self-efficacy, ineffective time management, and difficulties in emotional regulation may also contribute to delayed academic task completion. Students experiencing academic stress may postpone academic responsibilities not only because of engagement with digital technologies but also because stress can reduce confidence in task completion, impair planning and prioritization, and promote avoidance-oriented coping strategies. From a self-regulation perspective, procrastination may reflect broader difficulties in maintaining goal-directed behavior under stressful conditions. Therefore, the pathway identified in this study should be interpreted as one of several possible mechanisms that may contribute to procrastination behavior among nursing students rather than as a dominant explanatory process. These findings suggest that digital distraction may represent one relevant behavioral pathway associated with procrastination in contemporary learning environments.

A significant contribution of this study is the identification of resilience as a protective psychological resource that reduces academic procrastination and buffers the negative effects of academic stress. Students with higher levels of resilience demonstrated a weaker relationship between academic stress and procrastination, suggesting that resilience may enhance students' capacity to cope with academic challenges. Resilience is widely recognized as an important psychological factor supporting students' mental health and academic adaptation. Resilient individuals tend to employ more adaptive coping strategies, maintain motivation in challenging situations, and persist in goal-directed activities despite experiencing stress. A recent scoping review examining resilience among university students found that resilience is strongly associated with better psychological well-being and improved mental health outcomes (Ahluwalia et al., 2025). The moderating effect observed in this study suggests that resilience may strengthen students' emotional regulation and self-control, thereby reducing the likelihood that stress will lead to maladaptive behaviors such as procrastination. Students with higher resilience may interpret stressful academic situations as manageable challenges rather than overwhelming threats, allowing them to maintain engagement with academic tasks.

Implications

The findings of this study have several important implications for nursing education. First, the results highlight the need for academic institutions to address academic stress as a key factor influencing students' learning behaviors. Nursing programs are known for their rigorous academic and clinical requirements, which can place considerable psychological demands on students. Institutions should therefore consider implementing structured stress-management interventions, such as mindfulness-based training, cognitive-behavioral coping strategies, or resilience-building programs. Second, the mediating role of digital distraction suggests that digital literacy and self-regulation training should be incorporated into nursing curricula. Given the increasing integration

DOI: https://doi.org/10.17509/jpki.v12i1.97900
e-ISSN 2477-3743 | p-ISSN 2541-0024

of digital technologies in both education and clinical practice, students must develop the ability to manage digital distractions effectively. Educational strategies such as digital self-control training, structured study planning, and technology-assisted time management tools may help students maintain focus during academic activities. Third, the moderating role of resilience underscores the importance of fostering psychological resilience among nursing students. Educational institutions may integrate resilience-building programs into student support services, including mentorship programs, peer support groups, and mental health counseling services. Evidence suggests that resilience training programs can improve students' psychological well-being and academic persistence (Brewer et al., 2019). From a broader perspective, strengthening resilience may also have implications for future nursing practice. Nursing professionals frequently encounter high-stress clinical environments, and resilience has been identified as a critical factor for preventing burnout and maintaining professional competence. Therefore, cultivating resilience during nursing education may contribute to long-term workforce sustainability and improved patient care outcomes.

5. CONCLUSION

This longitudinal study identified temporal associations among academic stress, digital distraction, academic procrastination, and resilience among Generation Z nursing students. Higher academic stress was associated with higher academic procrastination both directly and through digital distraction operationalized as problematic smartphone use. The findings also suggest that resilience may function as a protective factor associated with lower procrastination and a weaker association between academic stress and procrastination. These findings highlight digital distraction as one potential behavioral pathway related to procrastination in contemporary learning environments characterized by high levels of digital engagement. However, given the observational nature of the study, the identified relationships should not be interpreted as definitive evidence of causality, and residual confounding cannot be excluded. From an educational perspective, interventions targeting stress management, digital self-regulation, and resilience development may support academic functioning and psychological well-being among nursing students. Future intervention and experimental studies are needed to confirm these relationships and determine whether modifying these factors leads to meaningful improvements in academic outcomes.

6. ACKNOWLEDGEMENT

The authors would like to express their sincere gratitude to all nursing students who voluntarily participated in this study. We also thank the academic staff and administrators from Universitas Sindang Kasih Majalengka, Universitas Muhammadiyah Cirebon, and STIKES Mitra Keluarga for their support during the data collection process.

7. FUNDING STATEMENT

This research received no external funding.

8. AUTHOR CONTRIBUTIONS

Conceptualization: DH, MC
Methodology: DH, MC, RAL
Data collection: DH, RS
Data analysis and interpretation: DH, MC, RAL
Writing—original draft preparation: DH
Writing—review and editing: MC, RAL, RS
Supervision: MC
All authors have read and approved the final version of the manuscript.

9. CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. The authors report no competing interests related to this study.

10. DATA AVAILABILITY STATEMENT

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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