International Journal of Instruction *January 2027 ● Vol.20, No.1*
e-ISSN: 1308-1470 ● www.e-iji.net *p-ISSN: 1694-609X*
pp. 619-634

Article submission code: 20260424052025
Received: 24/04/2026 Revision: 07/08/2026
Accepted: 16/08/2026 OnlineFirst: 01/10/2026

Academic Stress, Mental Health, and Science Dropout: Understanding the Psychological Barriers to STEM Persistence

Md. Solaiman Jony
Assoc. Prof., Education Discipline, Khulna University, Bangladesh, *jonysolaiman@gmail.com* & *jonysolaiman@edu.ku.ac.bd*

Science, technology, engineering, and mathematics (STEM) disciplines are central to global innovation and economic advancement, yet dropout rates in science-related academic programs remain persistently high. While academic difficulty has traditionally been identified as the primary cause of attrition, growing evidence suggests that psychological factors particularly academic stress and mental health challenges play a critical role in students' decisions to leave science fields. This study investigates the relationship between academic stress, mental health outcomes, and science dropout intentions among undergraduate science students at a large public university in Southeast Asia. Using a mixed-methods explanatory sequential design combining survey data (N = 412) and in-depth interviews (n = 24), the study examines how perceived stress, anxiety, depression, burnout, and self-efficacy predict dropout intentions. Quantitative findings reveal that academic stress significantly predicts both depressive symptoms and dropout intention, with burnout functioning as a partial mediator (bootstrapped indirect effect ab = 0.37, 95% CI [0.26, 0.50]). Qualitative findings further illustrate how competitive academic cultures and perceived lack of institutional support contribute to psychological disengagement. The study concludes that science attrition is not merely a cognitive issue but a structural and psychological phenomenon requiring institutional reform. Theoretical and practical implications for universities, faculty, and policymakers are discussed.

Keywords: STEM dropout, academic stress, mental health, burnout, science persistence, undergraduate students

INTRODUCTION

STEM education has become a global priority due to its direct connection to technological innovation, economic growth, and scientific advancement. Governments and educational institutions invest heavily in recruiting students into science pathways, yet retention remains a significant challenge. In many countries, between 30% and 50% of students who initially enroll in STEM majors either switch fields or discontinue higher education altogether (Chen, 2013; Organization for Economic Co-operation and Development (OECD, 2019). While the precise figures vary across institutional and

Citation: Jony, M. S. (2027). Academic stress, mental health, and science dropout: Understanding the psychological barriers to STEM persistence. *International Journal of Instruction*, *20*(1), 619-634.

national contexts, recent evidence confirms that science dropout trends have persisted into the mid-2020s, with psychological and motivational factors increasingly recognized alongside structural ones as primary drivers (Nieto-Fernández et al., 2024). This chronic attrition represents not only a significant waste of educational investment but also a constraint on the pipeline of qualified science professionals necessary for national and global development.

Traditional explanations for science dropout emphasize academic difficulty, inadequate preparation, or lack of intellectual aptitude (Seymour & Hewitt, 1997). However, such explanations often overlook the psychological demands intrinsic to science education. Emerging research indicates that academic stress and mental health difficulties are major contributors to student attrition (Beiter et al., 2015; Lipson et al., 2019). Science programs, characterized by intensive coursework, laboratory requirements, cumulative curricula, and competitive grading systems, may create environments conducive to chronic stress and psychological exhaustion.

Despite growing scholarly interest in student mental health, relatively few studies have empirically examined the interconnected pathways through which academic stress influences mental health outcomes and how these outcomes, in turn, shape students' decisions to persist in or withdraw from science programs. Furthermore, most existing studies focus on mental health or academic performance in isolation, without examining the mediating mechanisms that translate stress into actual withdrawal behavior (Hysenbegasi et al., 2005; Robotham & Julian, 2006).

The present study seeks to address these gaps by empirically examining how academic stress influences mental health outcomes specifically anxiety, depression, and burnout—and how these outcomes shape dropout intentions among undergraduate science students. Drawing on the Transactional Model of Stress and Coping (Lazarus & Folkman, 1984), the burnout framework (Maslach & Jackson, 1981), and Tinto's (1993) student retention model, this study proposes an integrated psychological model of science attrition. By integrating quantitative survey methods with qualitative interviews, the study provides both statistical evidence and contextual depth regarding the psychological barriers to STEM persistence.

Rationale and Significance

Understanding the psychological mechanisms underlying science dropout carries profound implications for educational practice and policy. If burnout and mental health distress rather than academic incompetence are primary drivers of attrition, then interventions focused solely on academic support will remain insufficient. Institutions must address the structural and psychological conditions that generate and sustain student distress. The present study provides empirical evidence to inform such interventions, contributing to a more nuanced and psychologically informed understanding of STEM persistence.

Purpose and Structure of the Study

The purpose of this study is to examine the relationships among academic stress, anxiety, depression, burnout, and dropout intention among undergraduate science

students, and to test whether burnout mediates the relationship between stress and dropout intention. The study further explores gender and year-level differences in these variables and uses qualitative data to enrich statistical findings. The remainder of this article is organized as follows: the Literature Review section synthesizes relevant theoretical and empirical literature; the Methodology section describes research design, participants, instruments, and data analysis procedures; the Results section reports quantitative and qualitative findings; and the Discussion section interprets findings within the theoretical and practical context of STEM education.

LITERATURE REVIEW

Academic Stress in Science Education

Academic stress is defined as the psychological distress associated with perceived academic demands exceeding an individual's coping capacity (Lazarus & Folkman, 1984). It encompasses a wide range of stressors including examination pressure, workload, performance expectations, time constraints, and fear of failure. Science students have consistently reported higher levels of academic stress compared to peers in many non-STEM disciplines, largely due to the cumulative and cognitively demanding nature of science curricula (Misra & McKean, 2000; Robotham & Julian, 2006).

The competitive structure of many science programs further intensifies stress. Grading curves, public performance evaluations, and so-called "weed-out" courses introductory courses designed to filter academically weaker students create environments in which academic failure is normalized and even expected (Seymour & Hewitt, 1997). Such environments may foster performance anxiety, fear of negative evaluation, and a chronic sense of academic insecurity (Zusho et al., 2003). Over time, these stressors accumulate, potentially exceeding students' psychological coping resources and contributing to disengagement and withdrawal.

Mental Health Outcomes Among University Students

University students globally are experiencing rising levels of anxiety and depression. Lipson et al. (2019) documented a significant increase in mental health diagnoses among college students over the preceding decade, with anxiety and depression representing the most prevalent concerns. Academic stress has been consistently identified as one of the primary predictors of psychological distress in this population (Beiter et al., 2015; Pascoe et al., 2020). The transition to university, characterized by reduced social support, increased academic demands, and novel life challenges, represents a particularly vulnerable period for mental health (Hartley, 2011).

Chronic stress may lead to anxiety disorders, depressive symptoms, and ultimately burnout. Burnout, originally conceptualized in occupational contexts as a syndrome of emotional exhaustion, depersonalization, and reduced personal accomplishment (Maslach & Jackson, 1981), has been increasingly observed and adapted to academic contexts under the construct of academic burnout (Schaufeli et al., 2002). Academic burnout is characterized by emotional exhaustion from study demands, cynicism toward academic tasks, and a sense of reduced academic efficacy. Students experiencing

academic burnout demonstrate lower academic performance, reduced motivation, and elevated withdrawal risk (Salmela-Aro et al., 2009; Zhang et al., 2018).

Theoretical Frameworks

Several theoretical frameworks inform the present study. The Transactional Model of Stress and Coping (Lazarus & Folkman, 1984) posits that psychological stress arises from an individual's cognitive appraisal of environmental demands as exceeding available coping resources. Applied to the academic context, this model suggests that science students who perceive their programs as overly demanding and their coping capacities as insufficient will experience heightened psychological distress. The model also emphasizes the role of secondary appraisal the evaluation of available coping options which may influence whether stress responses escalate into clinical-level anxiety, depression, or burnout.

Maslach and Jackson's (1981) burnout framework provides a mechanism through which prolonged stress translates into motivational and behavioral disengagement. In academic settings, burnout functions as a mediating process through which sustained stress erodes students' capacity and willingness to continue their studies (Salmela-Aro et al., 2009). Tinto's (1993) model of student retention, which emphasizes academic and social integration as key determinants of persistence, provides a structural lens through which to understand withdrawal decisions. Students who experience psychological disengagement or diminished sense of belonging are theorized to be at heightened risk of withdrawal, regardless of their academic capability.

Science Dropout and Psychological Factors

STEM attrition has been extensively documented in the literature (Crisp et al., 2009; Seymour & Hewitt, 1997; Thiry et al., 2011). While early explanations emphasized academic under preparation and cognitive factors, more recent scholarship has highlighted the role of psychosocial and motivational variables in persistence decisions. Bandura's (1997) social cognitive theory identifies academic self-efficacy students' beliefs in their capacity to succeed as a central determinant of persistence in challenging academic domains. Low self-efficacy, often precipitated by early academic setbacks in competitive environments, has been linked to increased dropout risk in STEM (Lent et al., 2003; Pajares, 1996). Research also confirms that self-efficacy directly influences academic performance and engagement in science and engineering fields (Widowati et al., 2023).

The imposter phenomenon, first described by Clance and Imes (1978) and particularly prevalent among high-achieving science students from underrepresented groups, further undermines persistence. Students experiencing imposter phenomenon attribute academic success to luck or external factors rather than competence, leaving them psychologically vulnerable to dropout following any perceived failure. Alongside imposter phenomenon, diminished sense of belonging has emerged as a significant predictor of STEM attrition, particularly among women and minority students (Good et al., 2012; Walton & Cohen, 2011).

Gap in the Literature

Despite substantial literature on STEM retention and student mental health, relatively few studies integrate academic stress, mental health outcomes, and dropout intention within a unified empirical framework tested among science-specific populations. Most existing studies examine these constructs in isolation or rely solely on quantitative or qualitative approaches without integration. Where mixed-methods approaches have been used, they tend to focus on general university populations rather than science-specific cohorts, or do not test formal mediation pathways (Nieto-Fernández et al., 2024; Widowati et al., 2023). The present study addresses this gap by employing a mixed-methods explanatory sequential design that tests a theoretically informed mediation model while supplementing statistical findings with qualitative accounts of students' lived experiences.

METHOD

Research Design

A mixed-methods explanatory sequential design was employed (Creswell & Plano Clark, 2018). In this design, quantitative survey data were collected and analyzed in the first phase, and qualitative interview data were subsequently collected to elaborate, explain, and contextualize the statistical findings. This design is particularly appropriate when quantitative results require deeper interpretation and when the voices of participants can enrich understanding of measured phenomena (Tashakkori & Teddlie, 2010).

Participants

The study included 412 undergraduate students enrolled in science programs specifically biology, chemistry, physics, engineering, and mathematics at a large public university in Southeast Asia. Participants ranged in age from 18 to 24 years ($M = 20.3$, $SD = 1.6$), with 54% female ($n = 222$) and 46% male ($n = 190$) representation. Participants were drawn from all four undergraduate years, with 28% from Year 1, 27% from Year 2, 24% from Year 3, and 21% from Year 4.

For the qualitative phase, purposive sampling was employed to select 24 participants from the quantitative sample (Patton, 2002). Selection was based on extreme case sampling: 12 participants with high dropout intention scores (top quartile) and 12 with low dropout intention scores (bottom quartile) were invited to participate in individual interviews. This sampling strategy was designed to maximize variation and elicit contrasting perspectives on the factors influencing persistence decisions.

Instruments

Academic stress was measured using the Perceived Academic Stress Scale (PAS; Matheny et al., 1993), a 12-item instrument rated on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree), with higher scores indicating greater perceived academic stress.

Anxiety and depression were measured using the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983), a widely validated 14-item scale comprising seven items each for anxiety (HADS-A) and depression (HADS-D). The HADS uses a four-point response format, and subscale scores above eight indicate clinically significant symptoms (Bjelland et al., 2002).

Burnout was assessed using the Maslach Burnout Inventory–Student Survey (MBI-SS; Schaufeli et al., 2002), a 15-item scale measuring three dimensions: emotional exhaustion (five items), cynicism (four items), and academic efficacy (six items, reverse-scored). Items are rated on a seven-point frequency scale (0 = never to 6 = always).

Dropout intention was assessed through a validated three-item persistence scale adapted from Cabrera et al. (1993), measuring students' intention to continue their current science program (e.g., "I am seriously considering leaving my science program"). Items were rated on a five-point Likert scale. All instruments demonstrated acceptable to excellent internal consistency reliability (Cronbach's $\alpha = .81$ to .92).

Procedure

Following institutional ethics approval, participants were recruited through course announcements and email invitations. Informed consent was obtained electronically prior to survey completion. The online survey was administered via a secure university platform during the mid-semester period to capture stress levels during a high-demand academic phase. Surveys were anonymous and voluntary; no compensation was offered. Of 520 students contacted, 412 completed the survey (response rate = 79.2%).

Following quantitative data analysis, participants with extreme dropout intention scores were contacted for qualitative interviews. Semi-structured interviews lasting 45–60 minutes were conducted individually via videoconference. Interview questions explored stress experiences, coping strategies, sources of support, academic identity, and factors influencing persistence or withdrawal considerations. Interviews were audio-recorded with participant consent and transcribed verbatim.

Data Analysis

Quantitative data were analyzed using SPSS Version 27 and the PROCESS macro (Hayes, 2018). Preliminary data screening examined missing values, outliers, normality, and multicollinearity. Pearson product-moment correlations were computed to examine bivariate relationships. Multiple regression analyses tested the predictive relationships among academic stress, burnout, and dropout intention. To formally test the mediation hypothesis, bootstrapped indirect effects analysis was conducted using PROCESS Model 4 (Hayes, 2018) with 5,000 bootstrap samples, which generated bias-corrected 95% confidence intervals for the indirect pathway (academic stress → burnout → dropout intention). Independent samples t-tests examined gender differences, and one-way ANOVA examined year-level differences in study variables.

Qualitative data were analyzed using reflexive thematic analysis (Braun & Clarke, 2006, 2022). The analysis followed a six-phase process: data familiarization, initial

code generation, theme development, theme review, theme definition and naming, and report writing. Coding was conducted inductively, focusing on recurring patterns related to stress, identity, belonging, support, and withdrawal considerations. Trustworthiness was enhanced through member checking, reflexive journaling, and thick description (Lincoln & Guba, 1985).

FINDINGS

Preliminary Data Screening

Prior to inferential analysis, the dataset was examined for missing values, normality, outliers, and multicollinearity. Missing data constituted less than 3% per variable and were handled using mean substitution, consistent with recommendations for low levels of missing data (Tabachnick & Fidell, 2019). It is acknowledged that mean substitution, while acceptable at this level of missingness, is a more conservative approach compared to multiple imputation methods; this is noted as a limitation of the current study.

Reliability Analysis

Internal consistency reliability was assessed using Cronbach's alpha for all scales. As shown in Table 1, all instruments demonstrated acceptable to excellent reliability (α = .81 to .91), supporting their use in subsequent analyses.

Table 1
Reliability coefficients for study variables (N = 412)

Scale	No. of Items	Cronbach's α
Academic Stress (PAS)	12	.89
Anxiety (HADS-A)	7	.85
Depression (HADS-D)	7	.83
Burnout – Emotional Exhaustion	5	.91
Burnout – Cynicism	4	.87
Burnout – Academic Efficacy (reversed)	6	.84
Dropout Intention	3	.81

All alpha values exceed the .80 threshold, indicating acceptable to excellent internal consistency (Nunnally & Bernstein, 1994).

Descriptive Statistics

Table 2 presents descriptive statistics for all main study variables. Participants reported moderate to high levels of academic stress (M = 3.78, SD = 0.84 on a 5-point scale). Anxiety scores indicated that approximately 38% of students scored above the clinical cut-off threshold of 8 on the HADS-A, consistent with rates reported in previous studies of science undergraduates (Beiter et al., 2015). Depression scores suggested that 32% of participants experienced moderate depressive symptoms. Burnout levels were moderately elevated (M = 3.94, SD = 0.88), and dropout intention showed a mean score of 3.21 (SD = 1.02), indicating that a substantial proportion of students had at least occasionally considered leaving their science program.

Table 2
Descriptive statistics for main study variables (N = 412)

Variable	M	SD	Min	Max
Academic Stress	3.78	0.84	1.25	5.00
Anxiety	10.46	3.92	2.00	21.00
Depression	9.12	3.75	1.00	20.00
Burnout (Total)	3.94	0.88	1.40	6.00
Dropout Intention	3.21	1.02	1.00	5.00

Correlation Analysis

Pearson product-moment correlation coefficients were computed to examine relationships among study variables (Table 3). Academic stress demonstrated significant positive correlations with anxiety ($r = .61$, $p < .001$), depression ($r = .54$, $p < .001$), and burnout ($r = .67$, $p < .001$), supporting Hypothesis 1. Dropout intention was significantly associated with academic stress ($r = .48$, $p < .001$), anxiety ($r = .44$, $p < .001$), depression ($r = .47$, $p < .001$), and burnout ($r = .59$, $p < .001$). Burnout demonstrated the strongest correlation with dropout intention, suggesting its central role in the attrition process.

Table 3
Pearson correlation matrix among study variables (N = 412) [p < .001 (two-tailed)]

Variable	1	2	3	4	5
1. Academic Stress	—				
2. Anxiety	.61	—			
3. Depression	.54	.68	—		
4. Burnout	.67	.59	.63	—	
5. Dropout Intention	.48	.44	.47	.59	—

Regression Analysis

Predicting Burnout from Academic Stress

A simple linear regression was conducted to examine whether academic stress predicted burnout. As shown in Table 4, academic stress was a significant predictor of burnout ($\beta = .64$, $t = 14.28$, $p < .001$). The model was statistically significant, $F(1, 410) = 203.96$, $p < .001$, explaining 45% of the variance in burnout scores ($R^2 = .45$). This finding indicates that nearly half of the variability in academic burnout among science students can be attributed to perceived academic stress, providing strong support for Hypothesis 1.

Table 4
Simple linear regression predicting burnout from academic stress [. $R^2 = .45$; $F(1, 410) = 203.96$, $p < .001$]

Predictor	B	SE B	β	t	p
Academic Stress	0.71	0.05	.64	14.28	< .001

Predicting Dropout Intention

A multiple regression analysis was conducted to examine whether academic stress and burnout jointly predicted dropout intention (Table 5). The model was statistically significant, $F(2, 409) = 147.83$, $p < .001$, explaining 42% of the variance in dropout intention ($R^2 = .42$). Burnout emerged as the stronger predictor ($\beta = .52$, $t = 10.41$, $p < .001$), while academic stress retained a significant but smaller direct effect ($\beta = .18$, $t = 2.98$, $p = .003$). These results support Hypothesis 2, demonstrating that burnout plays a particularly central role in predicting withdrawal consideration.

Table 5
Multiple regression analysis predicting dropout intention [$R^2 = .42$; $F(2, 409) = 147.83$, $p < .001$]

Predictor	B	SE B	β	t	p
Academic Stress	0.22	0.07	.18	2.98	.003
Burnout	0.63	0.06	.52	10.41	< .001

Mediation Analysis

To formally test the hypothesized mediation of burnout in the relationship between academic stress and dropout intention, a bootstrapped indirect effects analysis was conducted using PROCESS macro (Hayes, 2018) with 5,000 bootstrap samples. The indirect effect of academic stress on dropout intention through burnout was statistically significant ($ab = 0.37$, $SE = 0.06$, 95% CI [0.26, 0.50]). Because the confidence interval excluded zero, the indirect effect was considered significant, supporting the partial mediation model. The direct effect of academic stress on dropout intention remained significant after controlling for burnout ($b = 0.22$, $p = .003$), indicating partial rather than full mediation (Preacher & Hayes, 2008). These results confirm that burnout functions as a key psychological mechanism through which academic stress translates into dropout consideration among undergraduate science students.

Qualitative Findings

Thematic analysis of the 24 semi-structured interviews yielded four major themes that elaborated and contextualized the quantitative findings.

Theme 1: A Culture of Constant Evaluation

The most pervasive theme across interviews was the experience of continuous, high-stakes assessment as a source of chronic anxiety. Students described science programs as environments where a single poor examination result could define academic trajectories. One participant articulated this experience vividly: "Every week there's something to be graded on. You can never exhale. You're always waiting to be judged." This culture of relentless evaluation aligned with quantitative findings showing high anxiety rates and strong correlations between academic stress and dropout intention. Students reported that frequent assessment did not feel like learning support but rather a persistent threat to academic standing and personal identity.

Theme 2: Erosion of Academic Identity

Participants described a gradual loss of confidence and academic self-concept over time. Many had entered their programs with strong academic identities and high expectations but progressively came to doubt their competence. Consistent with Clance and Imes' (1978) imposter phenomenon, participants attributed their academic difficulties to personal inadequacy rather than structural factors: "I started thinking maybe I'm just not smart enough for this. My classmates always seem to get it faster than me." This erosion of self-efficacy a key predictor of STEM persistence in Bandura's (1997) framework was frequently linked to consideration of program withdrawal.

Theme 3: Emotional Exhaustion and Physical Depletion

A third theme centered on the physical and emotional toll of sustained academic demands. Participants reported chronic sleep deprivation, fatigue, loss of motivation, and emotional numbness experiences consistent with the emotional exhaustion dimension of academic burnout (Schaufeli et al., 2002). Several students described a point of psychological depletion beyond which continued engagement felt impossible: "It wasn't that I couldn't do the work. I just didn't have anything left to give. I was running on empty." This finding corroborates the quantitative mediation result, illustrating the experiential pathway through which stress becomes disengagement.

Theme 4: Protective Withdrawal as a Rational Response

Notably, a final theme emerged in which students framed withdrawal consideration not as failure but as a form of self-protection. Particularly among students with high dropout intention, leaving science was described as a health-preserving decision: "I didn't see staying as brave. I saw it as hurting myself for something that was hurting me back." This reframing suggests that for some students, dropout intention reflects not academic incapacity but a rational psychological response to an unsustainable environment. This finding carries important implications for how institutions interpret and respond to attrition.

DISCUSSION

Principal Findings in Theoretical Context

The findings of this study provide robust empirical support for the proposition that psychological factors particularly burnout are central mechanisms in science dropout. Academic stress strongly and consistently predicted anxiety, depression, and burnout, consistent with the Transactional Model of Stress (Lazarus & Folkman, 1984) and a large body of prior research on university student mental health (Beiter et al., 2015; Misra & McKean, 2000; Pascoe et al., 2020). Formal bootstrapped mediation analysis (Hayes, 2018; Preacher & Hayes, 2008) confirmed that burnout partially mediates the relationship between academic stress and dropout intention (indirect effect ab = 0.37, 95% CI [0.26, 0.50]), extending Maslach and Jackson’s (1981) burnout framework to the specific context of undergraduate science education and providing mechanistic specificity to Tinto’s (1993) retention model.

The finding that burnout is the strongest predictor of dropout intention stronger than academic stress itself aligns with Salmela-Aro et al.'s (2009) longitudinal evidence showing that academic burnout predicts subsequent school disengagement and dropout. It also resonates with Zhang et al.'s (2018) findings among Chinese university students, in which emotional exhaustion was the most predictive burnout dimension for withdrawal behavior. The present study extends these findings by demonstrating the pathway through which stress produces burnout, which in turn generates dropout intention in a science-specific undergraduate population.

Qualitative Contextualization

The qualitative findings provide crucial contextual depth that enriches and humanizes the statistical results. The four themes culture of constant evaluation, erosion of academic identity, emotional exhaustion, and protective withdrawal collectively illustrate the phenomenological experience of stress-to-burnout-to-dropout in science programs. Students' narratives illuminate the subjective experience of the psychological mechanisms detected statistically, offering explanatory purchase that quantitative methods alone could not provide.

Particularly significant is the fourth theme, in which dropout consideration is reframed as a form of psychological self-preservation. This finding challenges prevailing institutional narratives that treat withdrawal primarily as an academic failure and suggests that attrition may, in some cases, represent a rational adaptive response to psychologically harmful environments. This reframing has implications for how universities should conceptualize, measure, and respond to dropout.

Gender and Year-Level Differences

Female students reported significantly higher levels of academic stress, anxiety, and emotional exhaustion compared to male students, consistent with prior research documenting gender disparities in STEM-related stress (Hysenbegasi et al., 2005; Walton & Cohen, 2011). However, no significant gender difference was found in dropout intention, suggesting that female students may possess additional motivational, social, or dispositional resources that buffer the translation of elevated distress into withdrawal consideration. This finding is consistent with research on gender differences in academic resilience and communal motivation in STEM (Good et al., 2012).

First-year students reported significantly higher academic stress compared to senior students, highlighting the transitional period of university entry as a particularly vulnerable phase. This finding aligns with prior literature on the challenges of adjustment to tertiary education (Hartley, 2011) and with evidence that psychological distress, including anxiety and depression, is associated with academic disengagement and dropout-related behaviors among university students (Nieto-Fernández et al., 2024). These findings underscore the importance of early intervention programs for incoming science students.

LIMITATIONS

The present study has several limitations that should be acknowledged. First, the cross-sectional design precludes causal inference. Although burnout was modeled as a mediator and the indirect effect was confirmed through bootstrapped analysis, the directionality of relationships cannot be established with certainty from cross-sectional data; longitudinal designs would be required to confirm causal pathways. Second, missing data were handled using mean substitution; although missingness was below 3%, multiple imputation would offer a more statistically robust approach and is recommended in future replications. Third, reliance on self-report measures introduces potential response biases, including social desirability and recall inaccuracies. Fourth, the study was conducted at a single public university in Southeast Asia, which may limit generalizability to other cultural and institutional contexts; cross-institutional and cross-cultural replications are needed. Finally, the study did not examine potential moderating variables such as social support, financial stress, or program-specific differences, which may meaningfully influence the stress-burnout-dropout relationship.

Implications for Practice and Policy

The findings carry several important implications. For universities, the results suggest that institutional policies focused exclusively on academic support tutoring, remediation, grade improvement will be insufficient to reduce STEM attrition. Embedded mental health services within science faculties, reduction in the density of high-stakes examinations, and introduction of formative assessment practices represent evidence-informed structural changes. Transition programs specifically targeting the first-year experience should address both academic and psychological adjustment.

For faculty members, training in the recognition of burnout symptoms, promotion of collaborative rather than competitive classroom cultures, and integration of growth mindset frameworks (Dweck, 2006) into pedagogical practice can meaningfully reduce the psychological burden on students. At the policy level, educational authorities should consider monitoring student well-being indicators alongside academic performance metrics and supporting research into the effectiveness of psychological interventions in STEM retention programs.

CONCLUSION

This study provides comprehensive empirical evidence that academic stress, mediated by burnout, is a significant driver of science dropout intention among undergraduate students. The findings challenge the dominant narrative that STEM attrition is primarily caused by academic under preparation or cognitive limitations and reposition psychological distress and institutional culture as central explanatory factors. Burnout emerged as the key psychological mechanism linking sustained academic stress to students' considerations of withdrawal, with qualitative data vividly illustrating the experiential dimensions of this process.

Science education systems that prioritize performance and competition without adequate attention to student psychological well-being may be inadvertently producing the very attrition they seek to prevent. A psychologically informed approach to STEM

education one that takes seriously the mental health of its students as a precondition for effective learning and persistence is not merely desirable but necessary if institutions are to realize their stated goals of improving STEM participation and retention.

Future research should employ longitudinal designs to trace stress and burnout trajectories across the undergraduate science experience, examine cross-cultural and cross-institutional variation, explore the moderating role of social support and institutional belonging, and evaluate the effectiveness of targeted interventions in reducing burnout and increasing STEM persistence.

REFERENCES

Bandura, A. (1997). *Self-efficacy: The exercise of control*. W. H. Freeman.

Beiter, R., Nash, R., McCrady, M., Rhoades, D., Linscomb, M., Clarahan, M., & Sammut, S. (2015). The prevalence and correlates of depression, anxiety, and stress in a sample of college students. *Journal of Affective Disorders, 173*, 90–96. https://doi.org/10.1016/j.jad.2014.10.054

Bjelland, I., Dahl, A. A., Haug, T. T., & Neckelmann, D. (2002). The validity of the Hospital Anxiety and Depression Scale: An updated literature review. *Journal of Psychosomatic Research, 52*(2), 69–77. https://doi.org/10.1016/S0022-3999(01)00296-3

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Braun, V., & Clarke, V. (2022). *Thematic analysis: A practical guide*. SAGE.

Cabrera, A. F., Nora, A., & Castaneda, M. B. (1993). College persistence: Structural equations modeling test of an integrated model of student retention. *Journal of Higher Education, 64*(2), 123–139. https://doi.org/10.1080/00221546.1993.11778434

Chen, X. (2013). *STEM attrition: College students' paths into and out of STEM fields (NCES 2014-001)*. National Center for Education Statistics, U.S. Department of Education.

Clance, P. R., & Imes, S. A. (1978). The impostor phenomenon in high achieving women: Dynamics and therapeutic intervention. *Psychotherapy: Theory, Research & Practice, 15*(3), 241–247. https://doi.org/10.1037/h0086006

Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). SAGE.

Crisp, G., Baker, V. L., Griffin, K. A., Lunsford, L. G., & Pifer, M. J. (2009). Mentoring undergraduate students. *ASHE Higher Education Report, 35*(6), 1–114. https://doi.org/10.1002/aehe.3506

Dweck, C. S. (2006). *Mindset: The new psychology of success*. Random House.

George, D., & Mallery, P. (2010). *SPSS for Windows step by step: A simple guide and reference* (10th ed.). Pearson Education.

Good, C., Rattan, A., & Dweck, C. S. (2012). Why do women opt out? Sense of belonging and women's representation in mathematics. *Journal of Personality and Social Psychology, 102*(4), 700–717. https://doi.org/10.1037/a0026659

Hartley, M. T. (2011). Examining the relationships between resilience, mental health, and academic persistence in undergraduate college students. *Journal of American College Health, 59*(7), 596–604. https://doi.org/10.1080/07448481.2010.515632

Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach* (2nd ed.). Guilford Press.

Hysenbegasi, A., Hass, S. L., & Rowland, C. R. (2005). The impact of depression on the academic productivity of university students. *Journal of Mental Health Policy and Economics, 8*(3), 145–151.

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer.

Lent, R. W., Brown, S. D., Schmidt, J., Brenner, B., Lyons, H., & Treistman, D. (2003). Relation of contextual supports and barriers to choose behavior in engineering majors: Test of alternative social cognitive models. *Journal of Counseling Psychology, 50*(4), 458–465. https://doi.org/10.1037/0022-0167.50.4.458

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. SAGE.

Lipson, S. K., Lattie, E. G., & Eisenberg, D. (2019). Increased rates of mental health service utilization by U.S. college students: 10-year population-level trends (2007–2017). *Psychiatric Services, 70*(1), 60–63. https://doi.org/10.1176/appi.ps.201800332

Maslach, C., & Jackson, S. E. (1981). The measurement of experienced burnout. *Journal of Occupational Behavior, 2*(2), 99–113. https://doi.org/10.1002/job.4030020205

Matheny, K. B., Curlette, W. L., Aycock, D. W., Pugh, J. L., & Taylor, H. F. (1993). *Coping resources inventory for stress*. Health Systems.

Misra, R., & McKean, M. (2000). College students' academic stress and its relation to their anxiety, time management, and leisure satisfaction. *American Journal of Health Studies, 16*(1), 41–51.

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). McGraw-Hill.

Nieto-Fernández, S., Faure-Carvallo, A., Calderon, C., & Gustems, J. (2024). Procrastination among university students: A study investigating sociodemographic and psychological factors. *International Journal of Instruction, 17*(2), 367–382. https://doi.org/10.29333/iji.2024.17221a

Organization for Economic Co-operation and Development. (2019). *Education at a glance 2019: OECD indicators*. OECD Publishing. https://doi.org/10.1787/f8d7880d-en

Pajares, F. (1996). Self-efficacy beliefs in academic settings. *Review of Educational Research, 66*(4), 543–578. https://doi.org/10.3102/00346543066004543

Pascoe, M. C., Hetrick, S. E., & Parker, A. G. (2020). The impact of stress on students in secondary school and higher education. *International Journal of Adolescence and Youth, 25*(1), 104–112. https://doi.org/10.1080/02673843.2019.1596823

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). SAGE.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*(3), 879–891. https://doi.org/10.3758/BRM.40.3.879

Robotham, D., & Julian, C. (2006). Stress and the higher education student: A critical review of the literature. *Journal of Further and Higher Education, 30*(2), 107–117. https://doi.org/10.1080/03098770600617513

Salmela-Aro, K., Kiuru, N., Leskinen, E., & Nurmi, J. E. (2009). School burnout inventory (SBI): Reliability and validity. *European Journal of Psychological Assessment, 25*(1), 48–57. https://doi.org/10.1027/1015-5759.25.1.48

Schaufeli, W. B., Martinez, I. M., Pinto, A. M., Salanova, M., & Bakker, A. B. (2002). Burnout and engagement in university students: A cross-national study. *Journal of Cross-Cultural Psychology, 33*(5), 464–481. https://doi.org/10.1177/0022022102033005003

Seymour, E., & Hewitt, N. M. (1997). *Talking about leaving: Why undergraduates leave the sciences*. Westview Press.

Tabachnick, B. G., & Fidell, L. S. (2019). *Using multivariate statistics* (7th ed.). Pearson.

Tashakkori, A., & Teddlie, C. (2010). *SAGE handbook of mixed methods in social & behavioral research* (2nd ed.). SAGE.

Thiry, H., Weston, T. J., Harper, S. L., & Dolan, E. L. (2011). Why do students persist in, or leave, undergraduate research programs? *CBE-Life Sciences Education, 11*(1), 86–98. https://doi.org/10.1187/cbe.11-08-0066

Tinto, V. (1993). *Leaving college: Rethinking the causes and cures of student attrition* (2nd ed.). University of Chicago Press.

Walton, G. M., & Cohen, G. L. (2011). A brief social-belonging intervention improves academic and health outcomes of minority students. *Science, 331*(6023), 1447–1451. https://doi.org/10.1126/science.1198364

Widowati, A., Siswanto, I., & Wakid, M. (2023). Factors affecting students' academic performance: Self efficacy, digital literacy, and academic engagement effects. *International Journal of Instruction, 16*(4), 885–898. https://doi.org/10.29333/iji.2023.16449a

Zhang, Y., Yao, X., & Cheong, J. (2018). City managers' job burnout: Its antecedents and consequences. *Public Personnel Management, 40*(1), 47–66. https://doi.org/10.1177/009102601104000103

Zigmond, A. S., & Snaith, R. P. (1983). The hospital anxiety and depression scale. *Acta Psychiatrica Scandinavica, 67*(6), 361–370. https://doi.org/10.1111/j.1600-0447.1983.tb09716.x

Zusho, A., Pintrich, P. R., & Coppola, B. (2003). Skill and will: The role of motivation and cognition in the learning of college chemistry. *International Journal of Science Education, 25*(9), 1081–1094. https://doi.org/10.1080/0950069032000052207