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The Impact of Achievement Goals and Resilience on Self-Efficacy for Learning Performance Among Undergraduate Students

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Abstract

This study investigates the roles of achievement goals and resilience in predicting self-efficacy for learning performance among undergraduate engineering students. One hundred and fifty students enrolled in a foundational engineering course at a public university in the southeastern United States completed measures with established evidence of validity of goal orientation, resilience, and self-efficacy. Hierarchical regression analysis revealed that resilience and mastery goals significantly predicted self-efficacy, while performance goals showed marginal significance. Mediation analysis indicated resilience partially mediated the relationship between mastery goals and self-efficacy. Practical implications for fostering resilience and mastery-focused strategies in engineering education are discussed, along with directions for future research.

Introduction

Students' academic performance and success in college are influenced by the quality of their engagement and motivation, alongside several other psychological factors. These challenges are particularly pronounced for undergraduate engineering students, who face academically demanding courses early in their studies. Achievement goals, resilience, and self-efficacy are pivotal in determining students' academic success. Achievement goals refer to the underlying motivations driving students' engagement with academic tasks, while resilience reflects their ability to recover from setbacks. Self-efficacy, defined as students' belief in their capacity to succeed, underpins their persistence and ability to overcome academic challenges [1-3]. These factors influence students' achievement behaviors and persistence in pursuing academic goals [4, 5].

Many undergraduate students struggle to maintain strong academic performance in foundational engineering courses, which are often critical for program progression. Students who fail to excel in these courses face delayed graduation and diminished academic confidence [6, 7].. Moreover, repeated academic struggles can create a cycle of poor performance, eroding self-efficacy and motivation [8-10]. Addressing these challenges early ensures students are equipped with the psychological tools to succeed.

Achievement goals, resilience, and self-efficacy are malleable and can be influenced by targeted educational practices [11-13]. For instance, mastery-oriented students often employ effective learning strategies and persist despite setbacks, whereas performance-oriented goals may lead to disengagement when abilities are questioned [14-16] Resilience enables students to manage academic stress better and persevere through challenges [17, 18]. Similarly, strong self-efficacy enhances students' confidence to take on and overcome obstacles[1, 19]. By understanding and fostering these constructs, educators can better support students' academic growth and persistence in demanding disciplines like engineering.

Despite their importance, limited research has explored the combined influence of achievement goals, resilience, and self-efficacy on academic performance, particularly in the context of

undergraduate engineering education. This study addresses this gap by investigating how these constructs interact to shape students' self-efficacy for learning performance. Specifically, it examines how achievement goals and resilience predict self-efficacy, offering insights into the psychological mechanisms that underpin effective learning.

Grounded in theories of achievement goals, resilience, and self-efficacy, this research aims to deepen understanding of how these variables influence student success. By examining their combined effects, the study provides a framework for designing targeted interventions to enhance academic performance, resilience, and motivation in challenging educational contexts. The findings aim to contribute to strategies that foster persistence, confidence, and overall success among undergraduate students in engineering and other demanding fields.

Theoretical Background

Positive academic performance among college students is vital to sustaining the STEM workforce. Multiple recent studies have examined the significance of self-efficacy, resilience, and goal orientation for positive academic outcomes of engineering students[16, 20]. This review explores the current literature on how academic goal orientations and resilience interact to shape self-efficacy for learning performance in engineering. Understanding these non-cognitive factors is crucial for fostering student success in this challenging and rigorous field.

Achievement Goal Theory: The Achievement Goal Theory (AGT) states that students' achievement behaviors and engagement with learning tasks depend on their goals and motives for achieving or being perceived as competent[16, 21]. The AGT builds on the foundational works of Dweck, Nicholls, and others who propose that students often adopt mastery-focused or performance-focused dispositions toward learning and competence [22].

Students with a mastery goal orientation are intrinsically motivated to attain competence or mastery of learning tasks solely for self-improvement or personal growth [16]. Conversely, students with performance goal orientation are driven by extrinsic factors, such as the need to demonstrate competence or avoid being perceived as incompetent relative to their peers (Geitz et al., 2016; Suter et al., 2022). Several achievement goal models have been proposed over the years, perhaps most notably, the 2 × 2 achievement goal model [23] . This model defines two dimensions of mastery and performance goals:

- **Mastery-approach goals** describe a positive disposition toward achieving competence by mastering a skill.
- **Mastery-avoidance goals** describe a negative disposition motivated by the desire to avoid incompetence.
- **Performance-approach goals** describe a motive to demonstrate superior performance relative to peers.
- **Performance-avoidance goals** describe a motive to avoid the perceptions of incompetence compared to peers.

The validity of the 2 × 2 framework has been extensively critiqued and refined in the literature [24, 25]. Elliot [26] proposed a **3 × 2 model** of achievement goal orientation that extends the 2 X 2 goal framework by observing that mastery-focused goal orientation is exhibited in two

dimensions: students may be intrinsically motivated to become competent by **focusing on mastering a task** or on **improving self**.

Resilience and Self-Efficacy: Many students face academic struggles, social pressures, personal difficulties, and financial or mental health concerns that can undermine their achievement goals and aspirations [27, 28]. Resilience is the ability to navigate challenges, overcome setbacks, and sustain progress despite adversity [29]. The positive psychology literature highlights that resilience is essential for students' mental and academic well-being, their persistence in the face of difficulties, and their likelihood of achieving academic success after setbacks. Self-efficacy refers to an individual's belief in their ability to perform specific tasks or achieve desired outcomes successfully [1]. Students' self-efficacy belief is critical in shaping motivation, effort, and perseverance, especially when faced with challenges. Several studies have highlighted the significance of self-efficacy in educational settings. High self-efficacy has been associated with increased motivation, academic achievement, and persistence in the face of obstacles [13, 30]. Students with high self-efficacy are likelier to approach challenging tasks as opportunities to learn and grow. In contrast, those with low self-efficacy may avoid such tasks or give up when difficulties arise.

Empirical Review

Several prior studies in engineering education explored the complex relationships between self-efficacy, achievement goal orientation, and resilience to varying depths. These studies emphasize the collective impact of these variables on student success. Self-efficacy, a critical mediator between achievement goals and academic outcomes, is pivotal in fostering persistence and adaptability among engineering students [16, 31, 32]. This effect is especially pronounced among students from disadvantaged backgrounds, underscoring its importance in addressing equity in education [33]. Achievement goal orientation, which shapes learning strategies, digital literacy, and self-efficacy, further reinforces its influence on academic performance [34].

Resilience has emerged as a cornerstone of engineering education, equipping students to overcome academic obstacles and tackle global challenges such as climate change [27, 35]. While technical expertise remains vital, a growing body of research advocates integrating resilience into engineering curricula to foster critical thinking, adaptability, and lifelong learning [36, 37]. Despite its recognized importance, resilience-focused interventions in existing educational frameworks remain sparse and inadequately developed [35], and even less so in engineering education.

The interconnectedness of achievement goals, self-efficacy, and resilience significantly influences academic performance and well-being. Mastery-oriented and performance-approach goals are [32]strongly associated with enhanced self-efficacy and academic resilience, driving improved performance, persistence, and mental health outcomes [38]. Resilience further amplifies goal-setting, self-regulation, and persistence, creating a robust foundation for academic and professional success [39]. Moreover, self-regulated learning—rooted in self-efficacy and strategic approaches—predicts academic achievement regardless of specific goal orientations [40]. Deep learning strategies, closely aligned with mastery goals, strengthen self-efficacy and optimize academic outcomes [41, 42].

While existing studies have provided valuable insights into the individual and combined roles of these constructs, the nuanced interplay between self-efficacy, achievement goals, and resilience in the context of engineering education requires further investigation. A comprehensive understanding of these relationships could inform the development of innovative, evidence-based interventions to enhance persistence, engagement, and performance in the demanding environment of engineering programs. Such efforts would not only address current gaps but also prepare students to meet the multifaceted challenges of an evolving global landscape.

Purpose of study

This study explores the roles of achievement goal orientations (AGO) and resilience in predicting self-efficacy for learning performance among undergraduate students. Additionally, it seeks to assess whether resilience mediates the relationship between achievement goals and self-efficacy. Grounded in existing literature, which emphasizes the influence of mastery goals, performance goals, and resilience on self-efficacy, we hypothesize that resilience will mediate the effects of achievement goal orientations on self-efficacy. Furthermore, mastery and performance goals are anticipated to exhibit both direct and indirect impacts on self-efficacy through resilience.

Research questions

To address these objectives, the study poses the following research questions:

1. What is the relative predictive significance of achievement goals (mastery and performance) and resilience on self-efficacy for learning performance?
2. Does resilience mediate the relationship between achievement goals and self-efficacy for learning performance?

By investigating these questions, the study seeks to contribute to a deeper understanding of the interrelationships between motivational and psychological constructs in shaping students' academic outcomes.

Methods

Sample and Procedure

This study enrolled 150 (64% male, 36% female) undergraduate engineering students in Engineering statics at a public university in the southeastern United States. Participants completed measures of academic resilience, achievement goals, and self-efficacy for learning performance. Institutional Review Board (IRB) approval was sought, and informed consent was obtained from the participants.

Measures

Achievement goal orientation: The 2 × 2 Achievement Goal Questionnaire (AGQ), developed by Elliot and McGregor (2001), assessed students' AGO. This instrument comprises four subscales: mastery-approach, mastery-avoidance, performance-approach, and performance-avoidance, each assessed using three items on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Higher scores indicate stronger alignment with the respective goal orientation.

In a recent study [20], the AGQ showed strong psychometric properties with a sample of undergraduate engineering students. Example items include “My aim is to completely master the material” (mastery approach) and “I am striving to avoid performing worse than others” (performance-avoidance). Cronbach’s alpha values for the subscales ranged from 0.67 to 0.88, reflecting reliability levels from acceptable to high. This instrument effectively captured students’ achievement goals within the study context.

Resilience: Resilience was measured using the Connor-Davidson Resilience Scale [43]. The scale has 25-items that are assessed on a 5-point Likert scale that ranges from 0 ("not true at all") to 4 ("true nearly all of the time"), with higher scores indicating a greater resilience capacity. Originally developed to evaluate treatment outcomes for stress, anxiety, and depression, the CD-RISC has become a widely accepted instrument for assessing resilience across diverse contexts, including academic settings. In this study, the scale demonstrated excellent reliability with a Cronbach’s alpha of 0.910, confirming its suitability for evaluating resilience in the targeted undergraduate population.

Self-efficacy for learning performance: Self-efficacy, defined as the belief in one's capabilities to learn or perform tasks at specific levels, was first introduced by [1] and has been widely applied across diverse educational contexts and grade levels [20]. In this study, self-efficacy was assessed using the Self-Efficacy for Learning Performance (SLP) subscale from the Motivated Strategies for Learning Questionnaire (MSLQ) [5].

The eight-item SLP subscale measures students’ confidence in their ability to succeed in the course. An example item is: “I believe I will receive an excellent grade in this class.” The subscale demonstrated excellent reliability in this study, with Cronbach’s alpha of 0.927, confirming its robustness for assessing self-efficacy in the academic context.

DATA ANALYSIS AND RESULTS

Data analysis plan: The dataset was examined to ensure that assumptions for conducting regression analysis were satisfied([44, 45] before the analysis. The normality of the error plot indicated that the normality of distribution and homoscedasticity assumptions were not violated. The variance inflation factor (VIF) value was less than 2 and a standardized residual scatterplot was observed, indicating no issue with multicollinearity [46]. Residual analysis was performed to detect if there were influential outliers in the dataset. Maximum Cook's distance was less than 1, suggesting no outlying cases existed in the data. Subsequently, correlation and regression analyses were conducted using participants' Self-Efficacy for Learning Performance (SLP) scores as the dependent variable. The predictors included the achievement goals framework, specifically Mastery Goals (subdivided into Mastery-Approach and Mastery-Avoidance) and Performance Goals (subdivided into Performance-Approach and Performance-Avoidance), alongside Resilience Score. This analysis explored how distinct dimensions of achievement goals and resilience contribute to students’ self-efficacy in a learning context.

Table 1: Descriptive statistics, Cronbach alphas for scales, and zero-order correlation coefficients among variables

Variables	Mean	SD	α	1	2	3	4
1. Mastery Goal	4.12	0.63	0.801	1.00			
2. Performance Goal	3.91	0.82	0.750	0.452**	1.00		
3. Self-efficacy for Learning Performance	3.60	0.78	0.927	0.399**	0.293**	1.00	
4. Resilience Score	72.30	12.80	0.910	0.261**	0.100	0.463**	1.00

Correlation is significant at the 0.01 level (2-tailed).

Correlation and Hierarchical Regression Analyses: Table 1 presents the descriptive statistics, Cronbach's alphas, and zero-order correlation coefficients among the study variables. The data reveal small to moderate correlations between the variables, highlighting meaningful relationships. Specifically, moderate positive correlations were observed between mastery goals and self-efficacy for learning performance (SLP), supporting prior research on the role of mastery-oriented goals in enhancing academic confidence [47, 48]. Resilience also demonstrated a moderate positive correlation with SLP, aligning with evidence that resilience supports academic confidence and adaptability [49]. In contrast, the correlations between resilience and performance goals were weaker, suggesting that resilience is more strongly associated with intrinsic motivations, such as mastery goals [18].

Subsequently, a forced-entry multiple regression analysis was conducted to explore predictive relationships further. Table 2 summarizes the results of hierarchical regression analysis showing mastery goals, performance goals, and resilience scores as predictors of self-efficacy for learning performance (SLP). The overall model was significant $F(3, 147) = 22.589$, $p < .001$, $R^2 = .316$). The model explained 31.6% of the variance observed in students' self-efficacy for learning performance.

Among the predictors, resilience emerged as the strongest and most significant predictor ($\beta = .388$, $t(147) = 5.492$), suggesting that students with higher resilience were more likely to report higher self-efficacy in learning contexts. Mastery goals were also significant predictors ($\beta = .230$, $t(147) = 2.913$, $P = .004$), emphasizing the importance of learning-oriented motivation in fostering confidence. Performance goals approached significance ($\beta = .150$, $t(147) = 1.963$, $P = .051$), indicating a marginally significant association with self-efficacy. These results underscore the contributions of resilience and mastery goals in predicting students' self-efficacy for learning performance.

Table 2: Hierarchical Regression Analysis Predicting Self-Efficacy for Learning Performance

Model Variables	Unstandardized coefficients B	SE	β	T	*p*-value	R^2	Adjusted R^2	ΔR^2
Mastery Goal	0.287	0.099	0.23	2.913	0.004	0.316	0.302	0.316
Performance Goal	0.144	0.073	0.15	1.963	0.051			
Resilience Score	0.024	0.004	0.388	5.492	0			

Mediation Analysis

Furthermore, a mediation analysis was conducted to examine the role of resilience scores in mediating the relationships between mastery goals, performance goals, and self-learning performance (SLP). The results revealed that resilience scores partially mediated the relationship between mastery goals and SLP.

Direct Effects: The standardized coefficients for the final model indicated that the direct effects of mastery goals ($\beta = 0.286$, $p = 0.003$) and performance goals ($\beta = 0.144$, $p = 0.046$) on self-learning performance (SLP) were significant. Additionally, the direct effect of resilience scores on SLP was also significant ($\beta = 0.024$, $p < 0.001$). In contrast, the direct effect of performance goals on resilience scores was not significant ($\beta = -0.345$, $p = 0.801$).

Indirect Effects: The indirect path of mastery goals through resilience scores was significant ($\beta = 0.132$, $p = 0.007$), indicating that resilience scores partially mediated the effects of mastery goals on SLP. However, the indirect path of performance goals through resilience scores was not significant ($\beta = -0.008$, $p = 0.802$), suggesting that resilience scores did not mediate the relationship between performance goals and SLP.

DISCUSSION

The study results provide critical insights into the interplay between achievement goals, resilience, and self-efficacy for learning performance among undergraduate students. The hierarchical regression analysis revealed that mastery goals and resilience significantly predicted self-efficacy for learning performance, collectively explaining 31.6% of its variance. Resilience emerged as the strongest predictor, emphasizing its pivotal role in fostering students' confidence and adaptability in academic contexts. This finding aligns with prior research suggesting that resilient students are better equipped to manage challenges and maintain motivation [3].

Mastery goals also demonstrated a significant positive association with self-efficacy, supporting the view that intrinsic motivations centered on learning and self-improvement enhance academic confidence [26]. These results underscore the importance of fostering mastery-oriented goals to promote academic resilience and self-efficacy. While performance goals approached significance, their weaker association with self-efficacy highlights the limited influence of extrinsic motivations in sustaining confidence within learning environments. Although the

relationship was not statistically significant, the trend suggests that performance goals may still play a meaningful role in shaping self-efficacy under specific conditions. For instance, in learning environments that emphasize competition, external recognition, or graded performance, students motivated by performance goals may experience increased self-efficacy due to positive reinforcement and comparative success. This aligns with prior research suggesting that performance goals may be more beneficial in structured, high-stakes academic settings, such as standardized testing, STEM competitions, or project-based evaluations where clear benchmarks exist[50]. Future research could explore whether performance goals show stronger predictive power in settings where external validation is more explicitly tied to students' academic identity and confidence.

The mediation analysis further illuminated the role of resilience, which partially mediated the relationship between mastery goals and self-efficacy. This finding suggests that resilience amplifies the positive effects of mastery goals, creating a synergistic relationship that supports academic confidence. However, the lack of mediation between performance goals and self-efficacy indicates that extrinsic motivations are less aligned with adaptive psychological traits like resilience. These findings collectively emphasize the interplay between intrinsic goals and resilience in shaping effective learning behaviors.

Potential Implications for Theory and Practice

Our findings on the relationships between achievement goal orientations (AGO), resilience, and self-efficacy validate established theories in engineering education while offering practical avenues for enhancing student outcomes. Resilience emerged as a stronger predictor of self-efficacy than performance goals, echoing prior observations that intrinsic motivations and psychological adaptability outweigh extrinsic factors in predicting academic success [20]. These results suggest that resilience and mastery goals synergistically sustain academic confidence and performance [51].

Practically, this study supports the development of interventions to foster resilience and mastery-oriented goals. Strategies such as resilience workshops, mastery-focused tasks, and reflective practices could help students adapt to challenges and sustain motivation in demanding academic contexts. For example, engineering programs could incorporate resilience-building modules into foundational courses, teaching students to navigate setbacks while maintaining focus on self-improvement. Similarly, instructors could design assessments that prioritize skill mastery over comparative performance to reinforce intrinsic motivations. Additionally, integrating mentorship programs, adaptive learning technologies, and industry partnerships can further enhance student support systems, providing personalized learning experiences and real-world problem-solving opportunities that cultivate resilience and self-efficacy.

In addition, fostering resilience through experiential learning opportunities—such as internships, collaborative projects, or problem-based learning—can prepare students for both academic and professional challenges. By emphasizing adaptability, these interventions can equip students with the psychological tools needed to succeed in complex and evolving professional landscapes.

Limitations and Future Research

This study relied on self-reported measures, which, while supported by prior evidence of validity, may still introduce response biases [52]. Additionally, the sample consisted of 150 students from a single engineering course, limiting the generalizability of the findings. Future studies should include larger and more diverse samples to enhance representativeness. The cross-sectional design of this study also precludes causal conclusions about the relationships between resilience, achievement goals, and self-efficacy [53]. Longitudinal research is needed to explore how these constructs evolve over time and to establish causal pathways.

Future research should also test the effectiveness of specific interventions, such as resilience training programs or mastery-oriented curricular reforms, on enhancing self-efficacy in diverse educational contexts. Additionally, exploring cultural or institutional differences in the relationships between achievement goals, resilience, and self-efficacy could provide nuanced insights into how these constructs operate in varying settings. For example, comparative studies across disciplines or between individualistic and collectivist cultures could offer valuable perspectives.

Conclusion

In this study, we explored the influence of achievement goals and resilience on self-efficacy for learning performance. Consistent with prior research, our findings confirmed the significance of resilience and mastery goals as key predictors of academic confidence and success. The results underscore the importance of fostering resilience and intrinsic motivations in educational settings, particularly in demanding fields like engineering. However, the small sample size and cross-sectional nature of the study limits causal interpretations, highlighting the need for longitudinal and intervention-based research. Ultimately, strategies aimed at enhancing resilience and goal setting in students are likely to promote more positive learning experiences and outcomes, equipping students to meet both academic and professional challenges effectively.

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