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Mathematical Preparedness of Foundation Students and Its Impact on Academic Success During University Transition

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Abstract

The transition from school to university mathematics is a crucial stage that may have a major effect on individuals' academic achievement. Foundation students may face challenges that impact their performance, with some adapting effectively while others fail due to issues such as mathematics readiness, anxiety, and self-esteem. However, limited studies about foundation programs in Oman have investigated the cumulative effect of these characteristics on students' reported academic achievement. This study utilized a quantitative cross-sectional approach to investigate the links among mathematical readiness, mathematics anxiety, perceived academic support, self-confidence, and their impact on academic accomplishment. Data were gathered from 67 foundation students at the School of Foundation, National University of Science and Technology, through a structured Likert-scale questionnaire. The data were examined using descriptive statistics, correlation analysis, and multiple regression. The results indicated that mathematical preparation and anxiety were not significant predictors of academic achievement, but perceived academic support and self-confidence significantly positively influenced academic performance. These findings underscore the necessity of enhancing student confidence and delivering appropriate academic assistance during the transition to university.

Keywords:- Mathematical Preparedness, Mathematics Anxiety, Student Confidence, Academic Success, Foundation Students, Oman

I. INTRODUCTION

It is often acknowledged that the transition from school to university mathematics is a crucial and frequently difficult stage that influences individuals' academic paths on both an academic and emotional level. Studies regularly demonstrate that mathematics anxiety is linked to poorer academic achievement, diminished self-assurance, and diminished motivation, especially in courses that require a lot of arithmetic (Núñez-Peña et al., 2013). On the other hand, better academic achievement, enhanced engagement, and a greater interest in mathematics are associated with higher levels of confidence and self-efficacy (Zakariya, 2022; Roick & Ringeisen, 2018).

Nonetheless, the majority of current research looks at these elements either separately or in the context of general higher education. Despite this expanding corpus of work, little study has examined how anxiety, perceived academic support, and mathematical readiness interact concurrently to affect academic achievement throughout the transition period, especially in Oman's General Foundation Programs. This disparity is important because foundation programs are a specific period when students must make psychological and academic adjustments before moving on to more specialized fields.

Designing focused support techniques at the School of Foundation at the National University of Science and Technology requires a knowledge of whether anxiety and low confidence during this transition are related to mathematical ability. Thus, utilizing institutional survey data, this study attempts to investigate the combined impacts of mathematical readiness, anxiety, and perceived academic support/self-confidence on students' academic achievement during university transition.

1.1. Research objectives

- To describe students' levels of mathematical preparedness, difficulty/anxiety, support/confidence, and perceived academic success impact.
- To examine the association between readiness, difficulty/anxiety, and support/confidence with perceived academic achievement impact.
- To investigate whether these patterns vary by gender and educational background.

1.2. Hypotheses

- H1: Mathematical preparedness positively predicts the perceived impact on academic success.
- H2: Difficulty/anxiety negatively predicts the perceived impact on academic success.
- H3: Support/confidence positively predicts perceived academic success impact.

II. LITERATURE

The shift from secondary to university education presents significant academic and psychological difficulties, especially in mathematics-related fields. This transitional phase is frequently linked to alterations in learning expectations, heightened cognitive demands, and diminished structured support, potentially impacting students' academic performance and self-confidence.

Mathematical readiness is widely acknowledged as a crucial factor influencing academic success in higher education. Students who join a university with a solid basic understanding are typically more adept at managing complex mathematical ideas and problem-solving skills. Nevertheless, previous research indicates that readiness alone may not ensure success, especially when students face unexpected learning contexts and pedagogical approaches.

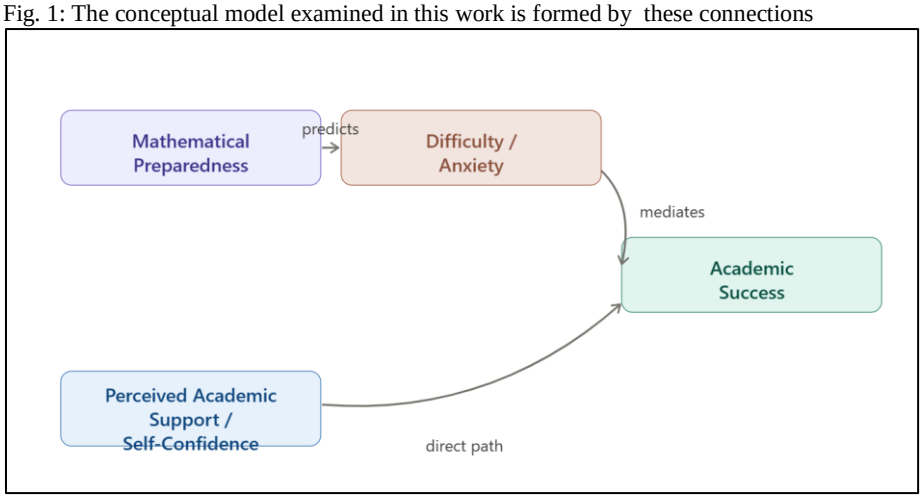
Mathematics anxiety is a significant factor affecting academic performance. It is characterized as a sensation of anxiety or apprehension that disrupts mathematical performance. Research conducted by Núñez-Peña et al. (2013) demonstrates that elevated mathematics anxiety correlates with diminished academic performance, decreased motivation, and evasion of mathematics-related activities. This indicates that emotional and psychological obstacles can substantially impede learning, even in kids possessing sufficient cognitive capacity. Conversely, self-efficacy originating from Bandura's (1997) social cognitive theory has been reliably recognized as a robust predictor of academic achievement. Self-efficacy denotes an individual's conviction in their capacity to effectively execute tasks. Students exhibiting elevated mathematical self-efficacy typically display enhanced tenacity, engagement, and resilience in confronting academic problems (Zakariya, 2022; Roick & Ringeisen, 2018). This underscores the significance of psychological confidence in influencing academic results. Moreover, perceived academic assistance is crucial during the transition phase. Assistance from educators, colleagues, and institutional resources can enhance adaption to university learning contexts. Hernández de la Hera et al. (2023) assert that academic support systems mitigate anxiety and bolster students' confidence, thereby promoting overall academic performance. Although there is substantial literature on these individual elements, few studies have investigated the synergistic impacts of mathematical readiness, anxiety, self-efficacy, and academic support within a unified analytical framework. This disparity is especially pronounced within the framework of General Foundation Programs in Oman, where students experience a pivotal transition period prior to engaging in specialized academic fields. Comprehending the interaction of these variables is crucial for formulating tailored interventions that improve student success during this phase.

2.1. Conceptual Structure

Based on the principle of self-efficacy, this study suggests that:

- Performance and confidence are impacted by mathematical readiness.
- Performance is negatively impacted by anxiety.
- Academic support increases self-assurance and academic achievement.

Fig. 1: The conceptual model examined in this work is formed by these connections



This research is based on Bandura's (1997) self-efficacy theory, which highlights the significance of personal beliefs in influencing behavior and performance. The conceptual framework posits that mathematical readiness and difficulty/anxiety directly affect academic success, whereas perceived academic support and self-confidence serve as essential enabling elements. Academic support is anticipated to bolster students' confidence, thus improving academic achievement. This framework facilitates the analysis of cognitive (preparedness) and psychological (anxiety and self-confidence) elements within a cohesive paradigm.

III. METHODOLOGY

This study employed a quantitative cross-sectional research methodology to investigate the correlations among mathematical preparation, mathematics anxiety, perceived academic support/self-confidence, and academic achievement among foundation pupils. Data were gathered through a standardized questionnaire and evaluated employing statistical methods. The survey instrument comprised Likert-type items evaluated on a five-point scale (1 = strongly disagree to 5 = strongly agree). The items were categorized into four composite variables: mathematical readiness, mathematics anxiety, perceived academic support/self-efficacy, and perceived academic achievement. The dependent variable in the inferential analysis was perceived academic achievement. A convenience sample method was employed to gather data from enrolled foundation students at the School of Foundation, National University of Science and Technology. This method aided data gathering but may restrict the ability to generalize the results.

3.1. Participants

Table 1. Participants

Characteristic	Value
Sample size	67
Age (years), mean ± SD	18.01 ± 0.51
Female	54 (80.6%)
Male	13 (19.4%)
Public school background	59 (88.1%)
Private school background	6 (9.0%)
International school background	2 (3.0%)
Level 1	2 (3.0%)
Level 2	65 (97.0%)
Engineering	30 (44.8%)
Medicine	20 (29.9%)
Artificial Intelligence	9 (13.4%)
Pharmacy	5 (7.5%)
ITMB	3 (4.5%)

3.2. Statistical procedures

The analysis of data employed both descriptive and inferential statistical techniques. Descriptive statistics, including means and standard deviations, were employed to summarize the primary variables. Cronbach's alpha coefficients were computed to evaluate the reliability of the measurement scales. The Shapiro–Wilk test was employed to assess the normality of the data distribution. Both Pearson (parametric) and Spearman (non-parametric) correlation studies were used to investigate the correlations between variables. The application of both approaches was warranted because of departures from normality in some variables. A multiple linear regression analysis (ordinary least squares) was performed to assess the predictive influence of mathematical readiness, mathematics anxiety, and perceived academic support/self-confidence on perceived academic achievement. Variance inflation factors (VIF) were computed to evaluate multicollinearity among predictors.
Group differences were examined using:

- Welch's t-test and Mann–Whitney U test for gender comparisons
- Kruskal–Wallis test for differences based on school background

Both parametric and non-parametric tests were used to ensure robustness of the findings, given the distributional characteristics of the data.

3.3. Ethical Considerations

Formal approval for this study was granted by the School of Foundation Studies (SoFS), National University of Science and Technology. Participants were clearly informed that the survey was conducted for academic research purposes, and their participation was voluntary. Informed consent was obtained prior to data collection. All responses were treated with strict confidentiality and anonymity, and no personally identifiable information was recorded or disclosed.

IV. RESULTS

The results show that while anxiety and mathematical readiness were not statistically significant, perceived academic support and self-confidence are the best indicators of academic achievement. This implies that earlier academic preparedness alone may not be as important during the transition phase as psychological and contextual elements. One explanation could be

that when kids start college, they have to adjust to new learning contexts where they need to be confident and have access to support networks. In contrast to some other research, there was no discernible effect of mathematical readiness, suggesting that without sufficient support systems, readiness might not be sufficient to ensure success. Similarly, the moderate levels of anxiety reported in this population might not have been high enough to affect results, which would explain the non-significant effect of anxiety.

4.1. Descriptive statistics and scale quality

Fig. 2 **:** Mean scores across the four composite scales (error bars = standard deviations).

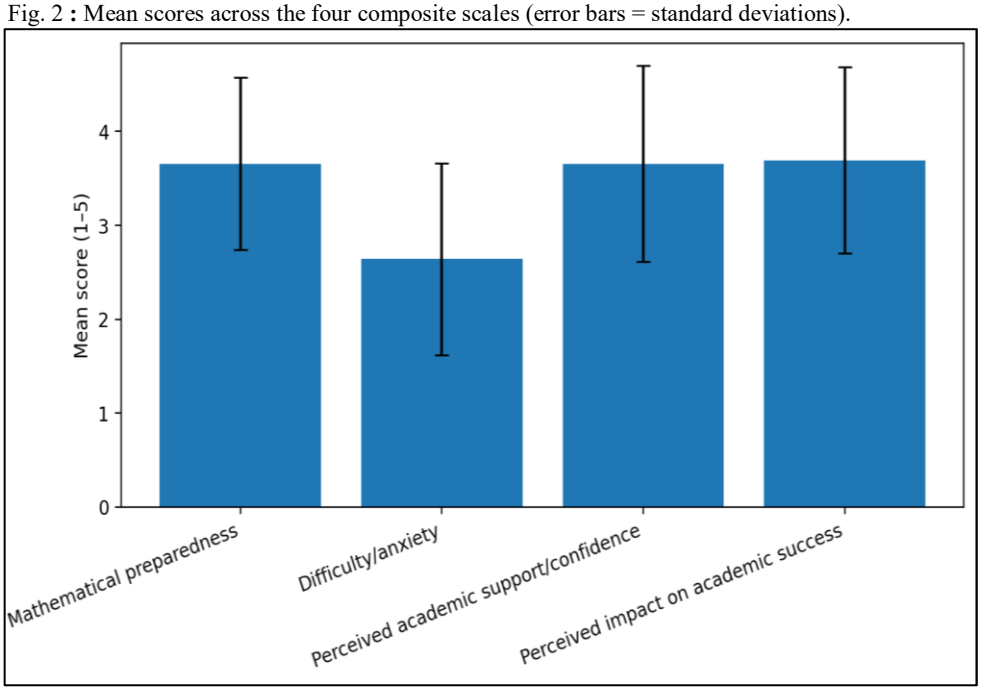


Table 2. Descriptive statistics

Variable	N	Mean	SD	Min	Median	Max
Mathematical preparedness	67	3.657	0.916	1.0	3.667	5
Difficulty/anxiety	67	2.642	1.022	1.0	2.667	5
Perceived academic support/confidence	67	3.657	1.045	1.5	4.000	5
Perceived impact on academic success	67	3.694	0.992	1.0	3.500	5

Table 2. Cronbach's alpha test

Scale	**Cronbach's alpha**
Mathematical preparedness	0.774
Difficulty/anxiety	0.781
Perceived academic support/confidence	0.816
Perceived impact on academic success	0.596

The mean scores for preparedness and support/confidence were identical (M = 3.657), indicating moderate-to-high levels of favorable opinion. The mean difficulty/anxiety level was 2.642, indicating that severe difficulty was not prevalent within the sample. The reliabilities for readiness, difficulty/anxiety, and support/confidence were satisfactory ($\alpha \geq .77$). However, the perceived academic achievement impact scale exhibited lower internal consistency ($\alpha = .596$), warranting cautious interpretation of that outcome.

4.2. Normality assessment

Table 3. Shapiro–Wilk W test

Variable	**Shapiro–Wilk W**	**p**
Mathematical preparedness	0.952	0.011
Difficulty/anxiety	0.968	0.083
Perceived academic support/confidence	0.916	0.000
Perceived impact on academic success	0.934	0.002

The Shapiro–Wilk tests revealed significant departures from normality for readiness, support/confidence, and perceived academic achievement impact ($p < .05$), but difficulty/anxiety did not depart substantially from normality ($p = .083$). This style facilitates the reporting of both Pearson and Spearman coefficients.

4.3. Correlation analysis

Fig. 3: Pearson and Spearman associations between the predictors and the perceived academic success impact

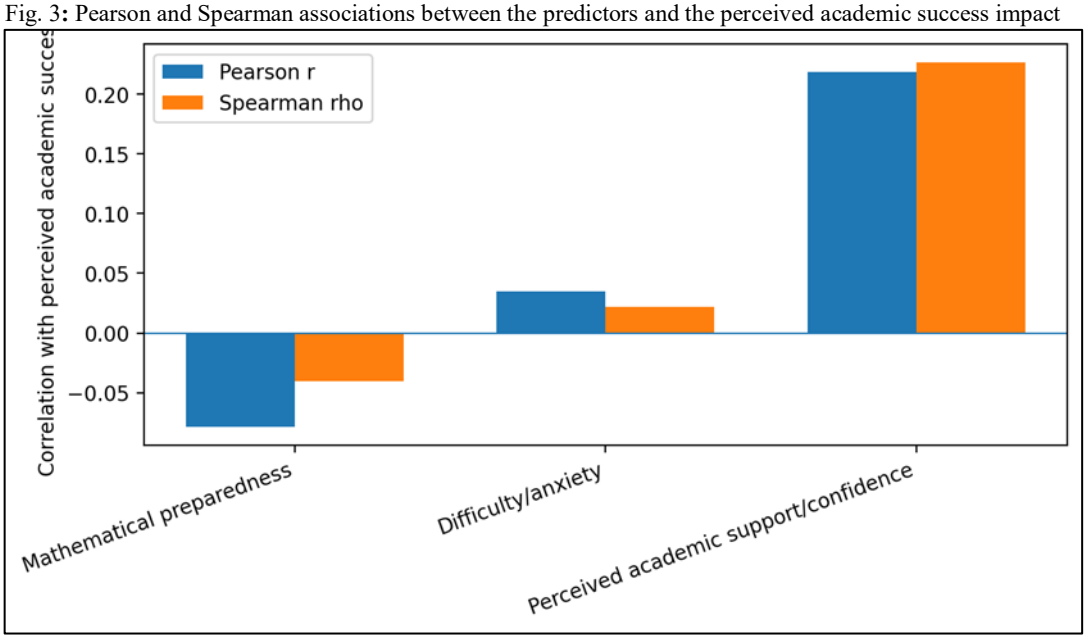


Table 4. Pearson and Spearman associations between the predictors and the perceived academic success impact

Predictor	Pearson r	Pearson p	Spearman rho	Spearman p
Mathematical preparedness	0.078	0.528	-0.040	0.747
Difficulty/anxiety	0.035	0.780	0.022	0.859
Perceived academic support/confidence	0.219	0.076	0.226	0.065

None of the bivariate associations attained the standard .05 significance threshold. Preparedness showed a minor, non-significant negative correlation with perceived academic performance impact (Pearson $r = -.078$, $p = .528$). The correlation between difficulty and anxiety was nearly nonexistent ($r = .035$, $p = .780$). Support/confidence emerged as the most robust predictor at the bivariate level, approached significance ($r = .219$, $p = .076$).

4.4. Multiple regression

Fig 4. Standardized beta coefficients from the multiple regression model

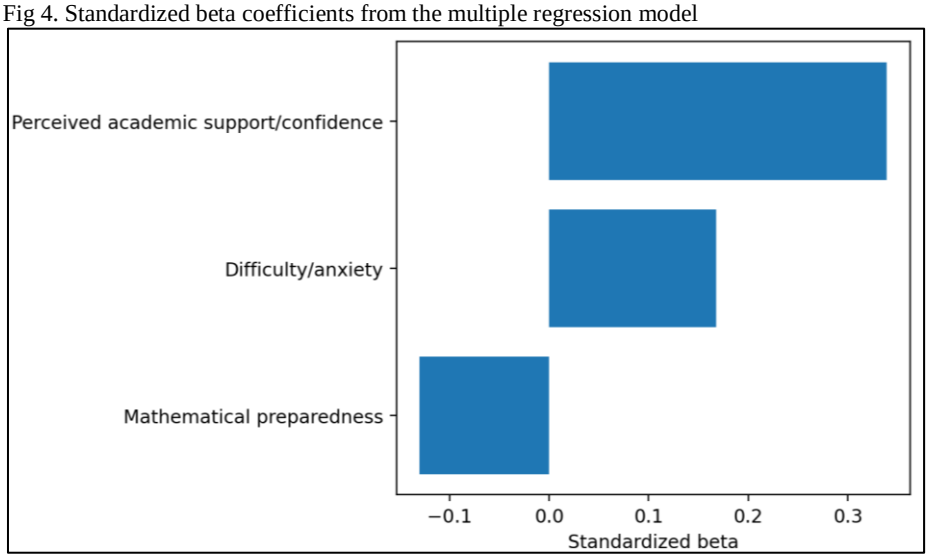


Table 5. Standardized beta coefficients from the multiple regression model

Term	B	SE	T	p	95% CI low	95% CI high
Const	2.599	0.874	2.974	0.004	0.853	4.346
Preparedness	-0.141	0.138	-1.021	0.311	-0.416	0.134
Difficulty Anxiety	0.163	0.136	1.197	0.236	-0.109	0.435
Support	0.322	0.134	2.410	0.019	0.055	0.589

Table 6. Model statistics

Model statistics	Value
R-squared	0.090
Adjusted R-squared	0.047
F	2.082
Prob_F	0.112
N	67.000

Table 7. Variable VIF (Variance inflation factor)

Variable	VIF (Variance inflation factor)
Const	54.555
Preparedness	1.117
Difficulty Anxiety	1.363
Support	1.373

The overall regression model was not statistically significant, $F(3, 63) = 2.082$, $p = .112$, with $R^2 = .090$ and adjusted $R^2 = .047$. The estimated regression equation for predicting perceived academic success was:

$$\hat{Y} = 2.599 - 0.141(\text{Preparedness}) + 0.163(\text{Anxiety}) + 0.322(\text{Support}) \quad (1)$$

This equation indicates that perceived academic success increases primarily with higher levels of support and confidence, while preparedness and anxiety show weaker, non-significant effects. Only support/confidence provided a distinct statistically significant contribution ($B = .322$, $p = .019$; standardized $\beta = .339$).

4.5. Group comparisons

Table 9. Gender differences in the study variables (Welch t-test and Mann–Whitney u test)

Variable	Female mean	Male mean	Welch t p	Mann–Whitney p
Mathematical preparedness	3.710	3.436	0.228	0.146
Difficulty/anxiety	2.660	2.564	0.757	0.799
Perceived academic support/confidence	3.639	3.731	0.746	0.949
Perceived impact on academic success	3.704	3.654	0.848	0.760

Table 10. Differences in the study Variables by school background (Kruskal-Wallis tests)

Variable	Kruskal p	Mean international	Mean private	Mean public	N international	N private	N public
Mathematical preparedness	0.267	3.167	3.167	3.723	2	6	59
Difficulty/anxiety	0.712	2.333	2.889	2.627	2	6	59
Perceived academic support/confidence	0.980	3.750	3.750	3.644	2	6	59
Perceived impact on academic success	0.150	2.500	4.083	3.695	2	6	59

No statistically significant gender differences were seen among the four composite variables utilizing either Welch tests or Mann–Whitney tests (all $p > .05$). Similarly, comparisons based on school history yielded no statistically significant results in Kruskal-Wallis tests (all $p > .05$), but students from private institutions reported a marginally greater perceived impact on academic success than their counterparts from public or foreign schools. Here, 'marginally greater' means that, although not statistically significant, students from private institutions reported a slightly higher mean perceived impact. However, these descriptive differences should be interpreted cautiously due to the small sizes of the private and international subgroups.

Table 11. Summary of hypothesis evaluation

Hypothesis	Statement	Test used	Decision	Evidence
H1	Mathematical preparedness positively predicts the perceived academic success impact.	Pearson, Spearman, OLS regression	Not supported	Pearson r=-0.078, p=0.528; regression p=0.311
H2	Difficulty/anxiety negatively predicts perceived academic success impact.	Pearson, Spearman, OLS regression	Not supported	Pearson r=0.035, p=0.780; regression p=0.236
H3	Support positively predicts perceived academic success impact.	Pearson, Spearman, OLS regression	Partially supported in regression	Pearson r=0.219, p=0.076; regression B=0.322, p=0.019

4.6. Hypothesis evaluation

H1 and H2 were not supported. H3 received the strongest support because support/confidence was significant in the regression model, even though its Pearson correlation only approached significance.

V. DISCUSSION

The most significant finding from this institutional dataset is that felt support and confidence, rather than readiness or anxiety alone, were the sole statistically significant predictors of perceived academic achievement impact. This discovery corroborates previous studies highlighting the essential influence of self-efficacy and confidence on academic achievement (Roick & Ringeisen, 2018; Zakariya, 2022). While difficulty/anxiety did not reach statistical significance in this study, prior research consistently indicates that elevated levels of mathematics anxiety correlate with diminished academic performance and adverse attitudes toward learning (Núñez-Peña et al., 2013; Hernández de la Hera et al., 2023). The discrepancy in findings may stem from reliance on perceived academic performance rather than actual academic outcomes. In the present group, anxiety levels were moderate instead of extreme, and the dependent variable assessed perceived impact on academic accomplishment rather than actual grades. This may have diminished the robustness of the observed correlation. Likewise, readiness did not surface as a favorable predictor. A conceivable interpretation is that students' opinions regarding readiness may intersect with their sense of confidence and support, whereas the outcome variable reflects subjective effect rather than objective academic achievement. The findings indicate that upon entering university, the support environment and self-assurance experienced by students may be more significant for perceived success than prior preparation alone.

VI. CONCLUSION

In this NU School of Foundation sample, students typically reported moderate to high levels of mathematical preparedness and support/confidence, along with moderate difficulty/anxiety. The inferential data did not substantiate a direct positive influence of preparedness or a direct negative influence of difficulty/anxiety on perceived academic success impact. Support/confidence was the sole significant predictor in the multivariable model. The practical implication is that transition support should encompass not only content revision but also confidence-building and accessible academic assistance.

VII. RECOMMENDATIONS

- Introduce early diagnostic screening to identify students with weak mathematical foundations and pair that screening with quick support pathways.
- Strengthen confidence-building practices in mathematics classes, including scaffolded examples, low-stakes practice, and feedback that emphasizes progress.
- Provide visible support channels such as tutoring, consultation hours, and peer-assisted learning for students experiencing transition-related stress.
- Track future cohorts using actual course grades so that institutional decisions can be based on both perceived and objective academic success indicators.

VIII. LIMITATIONS

This study used a relatively small convenience sample from one institutional context. The outcome variable was perceived academic success impact rather than official academic records, and one scale showed relatively weak reliability. In addition, some comparison groups were very small, especially students from international and private school backgrounds. These issues limit generalizability.

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