Entrepreneurship Education and Academic Performance: The Roles of Innovation and Technical Proficiency

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ABSTRACT: There This study investigates if there is a relationship between enrollment in an entrepreneurship course and GPA. It also studies if a student's ability for innovation mediates the relationship between their enrollment in an entrepreneurship course and GPA; while their technical skill level moderates the relationship. Secondary data (cross-sectional) from 210 students were used. Correlation analysis, OLS regression analysis, and the Hayes PROCESS Model #5 were used as statistical methods. There was no correlation at $p < .05$ between taking an additional entrepreneurial course and GPA. Additionally, the mediating effect of innovative thinking and the moderating effect of technical proficiency did not have a statistically significant effect on GPA. Therefore, taking additional courses in entrepreneurship may not result in better overall academic grades. The results indicate the need to evaluate both quality of education and what students learn.

KEYWORDS: Entrepreneurship Education, Academic Performance, Innovative Thinking, Technical Proficiency

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Introduction

Increasingly, universities have been promoting education about entrepreneurship to address problems and identify opportunities. Education in entrepreneurship is designed to develop skills that can also be useful outside of creating new ventures, such as creative thinking, working in teams and making decisions based upon practical experience (Shiri et al., 2025). However, typically academic success is measured by grades rather than by entrepreneurial activity (Kao & Tienda, 2022). Therefore, whether participation in courses related to entrepreneurship is positively correlated with GPAs is still a separate question from whether there will be increased entrepreneurial intent because of taking those courses (Zhou & Mei, 2026).

There has been prior evidence that shows entrepreneurship education can impact both entrepreneurial intentions and some specific competences. However, the level of evidence depends largely on the pedagogical methods used in the course(s), how they define "outcome", and how the researchers conducted their studies. For example, Nabi et al.

(2017) found that many studies rely on short-term subjective measures, while Bae et al. (2014) showed that there was a small correlation with entrepreneurial intentions that decreased when controlling for the initial level of entrepreneurial intent. This suggests that exposure to the course and performance in unrelated academic subject areas need to be studied separately. While a student's ability to recognize potential business opportunities may improve due to participation in an entrepreneurship course, this does not necessarily mean that he/she will receive better grades in other academic classes (Duval-Couetil et al., 2025).

One possible link between entrepreneurship coursework and GPA is innovative thinking. By providing the ability to iteratively experiment, generate ideas and interact constructively with ambiguity during class time, entrepreneurship courses provide students with ways to approach and complete assignments differently than before. This can lead to stronger learning experiences. Another boundary condition that may limit the connection between entrepreneurship coursework and GPA is technical competence. Technical competence would allow students to implement their ideas through digital media, prototyping (Aparicio et al., 2019; Beldar et al., 2025), etc. For the relationship between entrepreneurship coursework and GPA to exist, it would require that the curriculum is integrated appropriately and that the skills taught align with how students are assessed.

The purpose of this study is to evaluate the possibility of this relationship using data collected. Data include the number of courses taken in entrepreneurship, scores from assessments measuring creative thinking and technical skills, and GPA. Instead of evaluating the effect of participating in entrepreneurship courses on GPA using experimental methods, this study will use association-based hypotheses. The major contribution of this study will be to position GPA as the objectively measurable academic outcome at the center of an entrepreneurship-education model, while evaluating both a cognitive pathway linking course exposure to GPA via creative thinking, and a skill-based contingency where technical proficiency conditions this association.

Research Question

- How strong of an association exists between participating in courses related to entrepreneurship and GPA?
- Do creative thinking and technical proficiency account for/condition this association?

Objectives

- To explore the association between taking courses related to entrepreneurship and GPA;
- To measure the association between exposure to courses in entrepreneurship and levels of creative thinking;
- To calculate the indirect association through creative thinking;
- To determine if technical proficiency moderates the association between being exposed to courses related to entrepreneurship and GPA.

The focus of this study is on understanding the magnitude of associations, uncertainty surrounding estimates, and providing educators with guidance regarding the interpretations of relationships rather than focusing solely on statistical significance.

Literature Review

Entrepreneurship education generally refers to a learning process where students develop skills, attitudes and knowledge about finding and implementing new opportunities (Alsaffarini et al., 2026; Gera et al., 2026; Ojansivu et al., 2026). The traditional approaches for delivering these courses focus on developing students' business plans and venture management skills. On the other hand, experiential approaches use various forms of prototypes, real-

world problems and reflective practices to create a more realistic and hands-on learning environment. Hägg & Gabrielsson (2019) stated there is a shift away from didacticism and toward experience-based learning in education. Nabi et al. (2017) reported that in their review of 159 articles concerning the effects of entrepreneurship education, the authors indicated that many articles failed to clearly outline what learning outcomes were being measured and how they were being taught. As a result, the number of classes students take is merely an indication of potential exposure and should never be considered equivalent to measuring course quality or intensity of learning.

Most of the empirical evidence concerning entrepreneurship education has focused on the development of the intent to start a business and the acquisition of venture-related competences as opposed to actual GPAs. A meta-analysis performed by Bae et al. (2014) of 73 studies revealed a very modest positive relationship between entrepreneurship education and the intent to start a business; however, this association diminished significantly once previous intent was included in the model. In addition, Bernadó & Bratzke (2024) provided a comprehensive literature review of entrepreneurial competences emphasizing their multi-dimensional and context-dependent nature. The results of such a study indicate that performance on academic work may increase when students participate in entrepreneurship activities requiring them to apply analytical reasoning and perseverance to complete tasks. However, in cases where students' class schedules compete with their desire to pursue entrepreneurial interests or poor alignment exists between curricula and coursework, the opportunity for improved GPAs may be lost. Therefore, H1 hypothesizes that there will exist a positive correlation, but makes no claims that this correlation will be universal.

Innovative thinking is the proposed mediator. It involves generating novel and potentially valuable approaches to problems, challenging prior assumptions, and synthesizing knowledge across multiple domains. Many entrepreneurship assignments involve students discovering entrepreneurial opportunities and evaluating alternative solutions. Wang et al. (2022) observed significant positive correlations between entrepreneurship education and entrepreneurial creativity among Chinese students, with entrepreneurial inspiration accounting for some portion of the explained variance. Similarly, Li et al. (2023) demonstrated relationships among entrepreneurial education, creativity and entrepreneurial intention via psychological mediators. Such findings provide rationale for testing the pathway from course participation to creative thinking (H2), but do not suggest that creative thinking translates into GPAs. Therefore, H3 posits that creative-thinking ability is positively correlated with academic success and carries some proportion of the course-GPA association.

Technical proficiency represents a different type of skill enabling entrepreneurs to implement entrepreneurial ideas through application of appropriate technology (Deeds et al., 2000; Pennetta et al., 2024). For example, students who possess technological literacy related to software applications, digital research, and prototyping are likely to be better positioned to transform educational experiences into quantifiable/assessed products. Chen & Ifenthaler (2023) demonstrated the relevance of applied capabilities using practical online training to examine digital entrepreneurship competences. Although Lam et al. (2025) examined digital competence as a moderating variable within the entrepreneurship education context, they used digital entrepreneurial intention as their outcome measure instead of GPA. This distinction is important because an interaction effect established for intentions does not directly imply equivalency for academic grades. Therefore, H4 hypothesizes that the relationship between course participation and GPAs is stronger among those students possessing greater technical proficiency.

The combined conceptual framework provides several contributions by linking together disparate bodies of literature on entrepreneurship learning; innovative thinking; technical capability; and academic success. Additionally, this framework allows for meaningful null findings: if there is no relationship between taking courses and achieving a GPA, then the results can identify limitations to simple claims regarding educational spillovers. Nonetheless, cross-

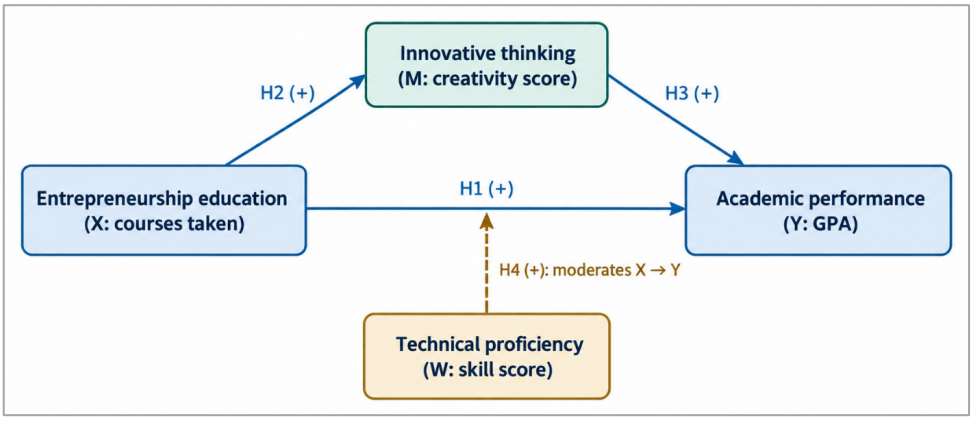
sectional analyses cannot ascertain whether students developed creative thinking before participating in courses or vice versa. Furthermore, neither course counts nor a single measure of creative thinking individually demonstrates construct validity by itself. Given these issues, they present reasons for explicit operational definitions and careful interpretations.

Conceptual Framework

This model includes academic achievement (Y) as the outcome or dependent variable; the influence of educational experiences in entrepreneurial endeavors (X) as the predictor or independent variable; creative thinking (M) as the mediating factor to link X and Y; and technical skills (W) as the moderating variable for the course-GPA relationship. Academic achievement is measured by GPA; however, due to limitations within this study, single-item proxies for both creative thinking and technical skills are used.

Figure 1

Proposed Conditional Process Model



H1: course exposure–GPA;
H2: course exposure–creativity;
H3: indirect association via creativity;
H4: moderation of the direct path.

A second mechanism exists between the hypothesized relationships. The first mechanism suggests that there will be an association between taking the course(s) and students' ability to think creatively, as well as a further association between students' ability to think creatively and GPA. The second mechanism suggests that the association between taking the course(s) and GPA may vary based on the student's level of technical skill.
Therefore, this represents a PROCESS MODEL 5 configuration. As such,

- **H1:** states that there will be a positive relationship between courses taken and overall GPA;
- **H2:** states that there will be a positive relationship between taking the course(s) and students' ability to think creatively;
- **H3:** states that the path from courses taken to GPA will be mediated by students' ability to think creatively;
- **H4:** states that there will be a significant interactive effect between courses taken and students' technical skill when predicting GPA. Using a cross-sectional regression analysis model, we test if the data collected supports all four hypotheses listed above.

Methodology

Research Design and Approach

A quantitative, explanatory research methodology was employed to determine whether there is a link between entrepreneurial education and academic success, and that this is mediated by the ability to think innovatively and also moderated by technical proficiency. An observational cross-sectional secondary-data analysis strategy was employed to test theoretical links. The conceptual framework included both direct and indirect (mediated) and conditional (moderated) effects, which were determined via regression-based moderated-mediation analysis.

Population, Sample, and Sampling Technique

A sample of 210 records was randomly selected using simple random sampling. This study investigated postulated relationships. The database contained demographic characteristics such as a variety of student performance data (academic performance; entrepreneurial education; innovative thinking; and technical skills) for the four major variables in this study. The researchers were unable to verify, independent of each other, the original sampling frame, recruitment methods, and collection process used to obtain this data; therefore, it is difficult to make claims regarding how representative this sample may have been of the larger population.

Measurement and Operationalization of Variables

The conceptual model included four measurable variables. The independent variable was defined by the number of entrepreneurial courses taken (from 0-4), representing "entrepreneurial education." The dependent variable, "academic performance," was defined as students' grade point average (GPA) (average of 2.01-4.00). The mediator variable was defined as the students' score on creative thinking (score range: 1-10), which represents "innovative thinking". Technical proficiency, the moderator variable, was defined as students' technical skills proficiency score (range: 1-10). These single-indicator measures were treated as observed variables rather than validated multi-item constructs.

Statistical Analysis and Hypothesis Testing

Data analysis was performed using IBM SPSS Statistics and Hayes PROCESS Macro Version 5.0. Pearson correlations were calculated to examine intercorrelations among the variables in addition to descriptive statistics. Subsequently, Ordinary Least Squares (OLS) regression was conducted to analyze the direct hypotheses (H1 and H2). Finally, Model 5 was used in a PROCESS analysis to examine whether or not both the mediating role of innovative thinking (H3), as well as the moderating role of technical proficiency (H4), had an impact on the established direct relationship between education for entrepreneurship and academic achievement. Variables in the interaction model were centered about their means. Bootstrapped estimates for indirect effects (5,000 resamples) with 95% percentiles as CI's were calculated. The regression diagnostics included variance inflation factors and Breusch-Pagan tests (Martin, 2023). Statistical significance was assessed at a 0.05 probability level.

Model Diagnostics and Robustness Assessment

Assumptions of linearity and homogeneity of variance were examined in residuals of regression models by evaluating normality of residuals, homogeneity of variance across predicted values and multicollinearity among predictors. For sensitivity testing purposes, heteroskedasticity-consistent HC3 robust standard errors were obtained. In addition to assessing the potential impact of omitted variables, additional exploration models containing age, gender and academic major as covariates were developed to assess how stable the previously estimated relationships would remain

when controlling additional factors. Tests of statistical significance were set at p<.05 with two-tailed tests where appropriate.

Statistical Software and Data Limitations

IBM SPSS linear regression and PROCESS Model 5 software programs were used for conducting all analyses directly. Institutional ethics approval constitutes an important methodological limitation.

Results and Discussion

Descriptive Statistical Analysis

Table 1 presents an overview of the descriptive statistics for each measure over the sample of 210 participants. Students reported on their participation levels in entrepreneurship courses using a scale from 1 to 7, with a mean score of 1.971 and a Standard Deviation (SD) of 1.424. This indicates that there is substantial variation in how much students are participating in their entrepreneurial coursework. In terms of academic performance, the average student had a cumulative Grade Point Average (GPA) of 3.047 with an SD of .572. For innovative thinking and technical proficiency, the means were 5.529 and 5.771, respectively, and the SDs were 2.894 and 2.843, respectively. With regard to both of these measures, the very large SDs suggest that there is considerable variation within students.

Table 1

Descriptive Statistics of the Study Variables (N = 210)

Variables	Mean	SD	Minimum	Maximum
Entrepreneurship Education	1.971	1.424	0	4
Academic Performance (GPA)	3.047	0.572	2.01	4.00
Innovative Thinking	5.529	2.894	1	10
Technical Proficiency	5.771	2.843	1	10

Note: SD = Standard Deviation

Correlation Analysis

Table 2 provides Pearson correlation coefficients for each variable in this study. Entrepreneurship Education had a weakly negative correlation with Academic Performance (r =- .068, p = .329) and a very weak positive correlation with Innovative Thinking (r = .005, p = .944). Technical Proficiency also had weak correlations with both Academic Performance (r=-.042) and Innovative Thinking (r=0.054); all were statistically insignificant (p>.05), indicating that there was insufficient statistical evidence to support the presence of significant linear relations among the three variables selected for analysis.

Table 2

Pearson Correlation Matrix

Variables	1	2	3	4
Entrepreneurship Education	1.000			
Academic Performance	–.068	1.000		
Innovative Thinking	.005	.008	1.000	
Technical Proficiency	–.084	–.042	.054	1.000

Note: N = 210. All correlations are statistically nonsignificant at p < .05.

Direct Relationship and Hypothesis Testing

Ordinary least squares regression was employed to examine the proposed direct relationships. The findings revealed that entrepreneurship education had a negative but statistically nonsignificant association with academic performance (b = –0.027, β = –.068, t = –0.979, p = .329). The model explained approximately 0.5% of the variance in GPA (R^2 = .005). Consequently, H1 was not supported.

Similarly, entrepreneurship education demonstrated a negligible positive relationship with innovative thinking (b = 0.0098, p = .944), indicating insufficient evidence that participation in additional entrepreneurship courses predicts higher innovative thinking scores. Therefore, H2 was not supported.

Mediating Effect of Innovative Thinking

The mediating role of innovative thinking was examined using regression-based mediation analysis with 5,000 nonparametric bootstrap resamples. The results revealed that innovative thinking had a positive but statistically nonsignificant coefficient in the adjusted academic performance model (b = 0.0107, p = .438). Furthermore, the estimated indirect effect of entrepreneurship education on academic performance through innovative thinking was 0.0020, with a 95% bootstrap confidence interval ranging from –0.0041 to 0.0100.

Since the confidence interval included zero, the indirect effect was statistically nonsignificant. Consequently, H3 was not supported. These findings suggest that innovative thinking did not significantly explain the association between entrepreneurship education and academic performance within the sample analyzed.

Moderation Analysis

The Moderation Effect of Technical Proficiency was explored with an Interaction of Entrepreneurship Education and Technical Proficiency. Results indicated a Positive but Non-Significant Interaction in terms of Statistical Significance (b = 0.0094, p = .369). A Conditional Effects Analysis also showed Negative Effects for Low (b = -0.0548, p = .175), Average (b = -0.0282, p = .315), and High Levels (b = -0.0015, p = .970) of Technical Proficiency. None of the Conditional Effects were Statistically Significant. As such, there is Insufficient Evidence to Support H4, which stated that Technical Proficiency would moderate the Proposed Relationship

Table 3

Summary of Hypothesis Testing Results

Hypotheses	Coefficient (b)	Statistical Evidence	Decision
H1: Entrepreneurship Education → Academic Performance	–0.0270	p = .329	Not Supported
H2: Entrepreneurship Education → Innovative Thinking	0.0098	p = .944	Not Supported
H3: Innovative Thinking as Mediator	0.0000	95% CI [–.0041, .0142]	Not Supported
H4: Technical Proficiency as Moderator	–0.0094	p = .369	Not Supported

Note: = Unstandardized regression coefficient; CI = Confidence Interval. H3 represents the indirect (mediation) effect estimated using 5,000 bootstrap resamples. Statistical significance was assessed at the 5% level (p < .05). All four hypotheses were not supported.

Table 4 presents the Pearson correlation results for 210 respondents. The analysis showed weak and statistically insignificant relationships among entrepreneurship education, academic performance, innovative thinking, and technical proficiency (p > 0.05). Overall, the findings indicate no statistically significant bivariate linear relationships among the study variables.

Table 4

Summary of Pearson Correlation Matrix

Pearson Correlation Matrix		Entrepreneurship Education	Academic Performance	Innovative Thinking	Technical Proficiency
Entrepreneurship Education	Pearson Correlation	1	-0.068	0.005	-0.084
	Sig. (2-tailed)		0.329	0.944	0.223
	N	210	210	210	210
Academic Performance	Pearson Correlation	-0.068	1	-0.008	-0.042
	Sig. (2-tailed)	0.329		0.913	0.550
	N	210	210	210	210
Innovative Thinking	Pearson Correlation	0.005	-0.008	1	0.054
	Sig. (2-tailed)	0.944	0.913		0.434
	N	210	210	210	210
Technical Proficiency	Pearson Correlation	-0.084	-0.042	0.054	1
	Sig. (2-tailed)	0.223	0.550	0.434	
	N	210	210	210	210

Model Diagnostics and Robustness Assessment

The entire Academic Performance Model explained roughly 1.08% of GPA variation (R^2= .0108; Adjusted R^2= -.0085) and failed to show a statistically significant result, F(4, 205)= 0.558, p = .693. VIFs were from around 1.005 to 1.021, showing little evidence for any serious multicollinearity, in addition to the fact that there was no statistical evidence of heteroscedasticity via the Breusch-Pagan test (p = .919). Thus, collectively these findings demonstrate an extremely limited amount of predictive ability without any serious multicollinearity and/or heteroscedasticity.

Graphical Interpretation of Results

Figure 2

Entrepreneurship Education and Academic Performance

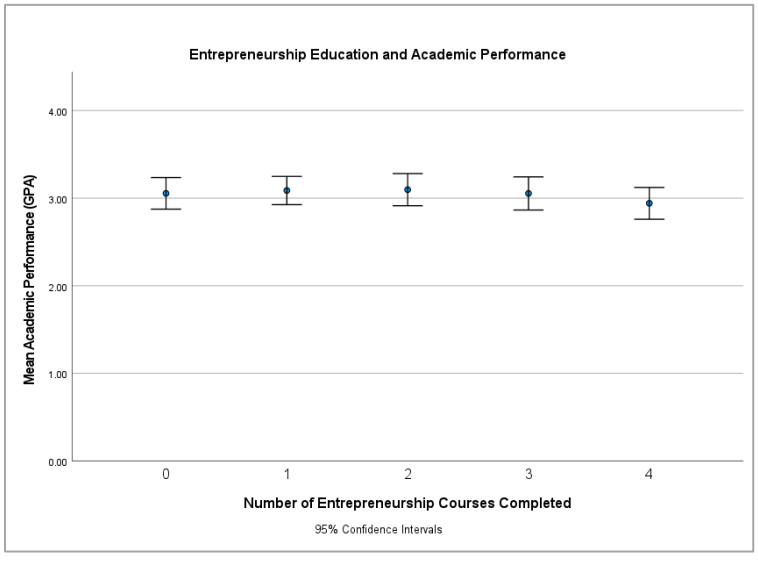
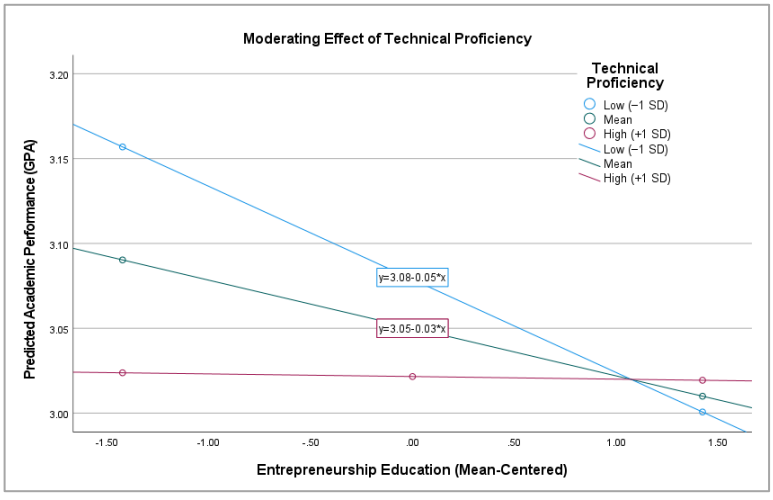


Figure 2 illustrates academic performance across different levels of entrepreneurship course participation. Although minor GPA variations were observed, the relationship remained statistically nonsignificant (p = .329). The findings suggest that additional entrepreneurship course participation was not reliably associated with higher academic achievement.

Figure 3

Moderating Effect of Technical Proficiency



Note: Lines represent predicted GPA at low (−1 SD), mean, and high (+1 SD) technical proficiency. The interaction effect was statistically nonsignificant (b = 0.0094, p = .3686).

Figure 3 illustrates the conditional association between entrepreneurship education and academic performance at low, average, and high technical proficiency levels. Although the negative regression slope became weaker at higher proficiency levels, the interaction remained statistically nonsignificant (p = .369). Therefore, the graphical findings do not establish a significant moderating effect. Therefore, H4 was not supported.

Figure 4

Pearson Correlation Matrix

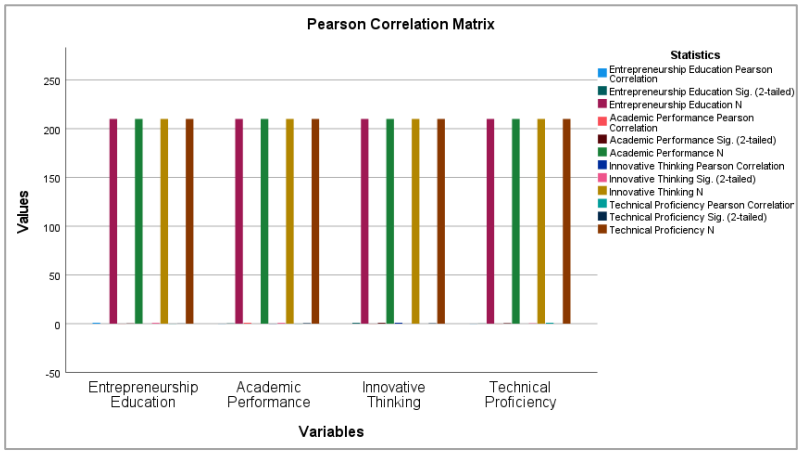


Figure 4 illustrates the Pearson correlation results for entrepreneurship education, academic performance, innovative thinking, and technical proficiency (N = 210). The findings indicate weak correlations among the variables, with all p-values exceeding 0.05. Overall, the results reveal no statistically significant linear associations among the variables examined in this study.

Conclusion and Limitation

The purpose of this study was to investigate the relationship between students' enrollment in entrepreneurship classes and their academic performance, with a focus on whether "innovative thinking" would mediate such a relationship, and whether "technical proficiency" would moderate it. Data from 210 students revealed there was no statistically significant direct relationship between students who have taken an entrepreneurship class (course) and their grade point average (GPA). Furthermore, neither the hypothesized mediation nor moderation was supported. Therefore, these results provide a warning for educators to avoid assuming that simply providing students with more opportunities to take entrepreneurship classes will lead to improved academic achievements. While taking the class(s) may create skills in areas which are not reflected in GPA, they can certainly do so.

There were several restrictions/limitations that qualified these results. Due to the nature of the data collected (cross-sectional, observational), we cannot make causal interpretations regarding the relationship examined. Additionally, since we did not verify the original sampling methods or determine if the sample was representative, we cannot say if our results generalize to other universities or student populations. Finally, since the data collected was based upon a measurement of students' exposure to entrepreneurship education through the number of courses they had completed (not quality of instruction), and due to reliance upon two single-item measures for assessing both "innovative thinking" and "technical proficiency," we may not be sensitive enough to detect any possible meaningful relationships among the variables studied.

For future research studies to better understand when/how entrepreneurship education impacts learning and/or academic success across different educational settings, researchers should utilize longitudinal or experimental designs utilizing samples from multiple universities and representing a variety of academic fields. Utilizing valid, multi-dimensional assessment tools to measure both creative-thinking abilities and technical competence, along with using a detailed assessment tool to evaluate the experience-based learning within each course being evaluated, the instructors' teaching effectiveness, the degree to which the curriculum is aligned with stated goals/outcomes of the course(s), etc. Researchers should also examine pre-existing differences in academic abilities among participants, in addition to studying other outcomes related to entrepreneurship education, such as entrepreneurial competencies, levels of student engagement, and ability to prepare ventures.

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