

Accounting, Engineering, and Information Science Students' Perceptions of an Entrepreneurial Learning Mindset: A Characteristics Model Framework

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Abstract

This prediction study focuses on students' perception of the characteristics which constitutes an entrepreneurial learning mindset¹ (ELM). The main outcome of the study is the development of an ELM Characteristic Model for the three academic major groups represented in the study, which could be used to promote learning in college. Survey data of 167 students in seven undergraduate courses were analyzed, using Descriptive statistics; General linear modeling; and Multivariate tests. We found accounting and business majors' ELM did not correlate significantly to the classical concepts of entrepreneurship, but rather to the social characteristics, such as positive attitudes, self-confidence, and dynamic outlook. Information technology and computer science majors perceive personality traits such as desires and motivation to accomplish, correlates to their ELM. Engineering and architecture majors' ELM correlated to the classical concept of entrepreneurship, such as owning a business and innovation, more than the accounting, business, information technology and computer science majors. Regardless of majors, students perceive an entrepreneurial minded learning context is required to help them develop and maintain their ELM.

Keywords: Entrepreneurial mindset, Entrepreneurial learning, Social entrepreneurship, Higher education.

Paper type: Research paper²

Introduction and Purpose

The theories of entrepreneurship are based on two historic concepts. The first is classical economics—a scientific endeavor employing business and management skills to successfully run an innovative endeavor or enterprise. The second views entrepreneurship as an art, grounded in the creative and innovative aspects of entrepreneurial behavior.

¹ Entrepreneurial learning mindset (ELM) An entrepreneurial mindset is defined for this study as the ability for students to use characteristics such as personal initiatives, opportunities, and preferences, etc., and contexts poised for improving the quality of their learning, and to clearly think about and define their learning goals.

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According to Drucker (1985; 2005) entrepreneurialism is neither science nor art—it is a practice! Drucker’s view is based on theories of economics and society yet assumes human behavior and activities leading to change. Most of the research and extant literature on the intersection of entrepreneurship and education focuses on programs, courses, curricula, business school education, training, and innovation skills to prepare students for entrepreneurial careers. By contrast, scholars (Fry and Jordan, 2011; Kriewall and Mekemson, 2010) who describe entrepreneurialism as a mindset, focus on the ability to sense, act, or mobilize under uncertain conditions and to clearly think about and define one’s own needs and goals, even in times of uncertainty. Our search of the extant literature found studies in this area of research, focuses on entrepreneurial learning as a process. For example, Elenurm (2012), Gürol and Atsan (2006), Pihie and Bagheri (2010), and Zhang, Duysters, and Cloodt (2014) focused on how students feel about entrepreneurship education. These studies are usually conducted at comprehensive research universities and business or engineering schools. Moreover, they are narrowly focused on the concept of the mindset relative to students becoming venture capitalists or owning their own businesses. In 2000, Shane and Venkataraman stated the field of social sciences lacked a useful conceptual framework, which explains the phenomenon of entrepreneurship. Rather, the concept is a broad label under which a hodgepodge of research related to small businesses or new firms is housed. They suggest that the field’s legitimacy is undermined, because many people have trouble identifying a distinctive contribution of the field to the broader domain of business studies.

We agree with Shane and Venkatarama (2000) because our review of the extant literature this many years later, did not reveal any studies with specific conceptual frameworks related to students’ perception of how characteristics of entrepreneurial mindset affects their learning. Consequently, this study explored students’ perceptions of their own attitudes, intrinsic behaviors, and self-motivation, which comprise the entrepreneurial mindset. They believe this mindset could help their learning and educational success in higher education. Specifically, it focuses on students’ perceptions of the characteristics— *independent variables* which constitute an Entrepreneurial Learning Mindset (ELM)—*the dependent variable*, which they can use to promote their own quality of learning. Major (degrees) are the *mediator variables*. The results are used to create an Entrepreneurial Learning Mindset Model (ELMM) for each major field of study.

This study was conducted at a polytechnic university. Participants were students pursuing various degrees (majors) in three main colleges: The School of Management; College of Engineering, Architecture and Construction, and the College of Information Technology and Computer Science. These majors are expounded on in the methodology section. The overarching finding of our study is students’ perceptions reveal characteristics of self-efficacy specifically related to several areas of the theory of the entrepreneurial behavior espoused by Drucker and others such as Fry and Jordan, 2011 and Jordan, Fry, and Van Treuren, 2016. These scholars suggest, creating value for others, requires perspective engineers’ technical skills to be coupled with an entrepreneurial mindset, while they are still in school. Overall, students perceive three contextual principles are necessary for them to develop and use their ELM: (a) purposeful, disciplined, and systematic learning context; (b) innovative learning context, and (c) strategy-based learning context. Our study finds Accounting and business entrepreneurial mindset do not agree with the traditional concepts of entrepreneurship, but rather to the social aspects of positive attitudes, motives, and self-confidence. Thus, this study extends the literature on the concept of entrepreneurial mindset to students learning, by creating an overarching entrepreneurial learning mindset framework, which is used as the basis for developing the specific characteristic models for the three majors in the study. The remainder of the paper is organized as follows: (I) literature overview, (II) conceptual framework, (III) methodology, (IV) results and discussions, (V) conclusion and the implications.

Literature Overview

This literature overview explores some of the studies in the areas of entrepreneurialism research and the link to higher education and learning. A review of the extant literature reveals a focus of three main genres: 1) the “student entrepreneurial mindset” from the perspective of art and science. 2) the social entrepreneurial learning process. 3) the entrepreneurial mindset in higher education programs. Writers such as Schumpeter (1934) and (1942) identified the entrepreneur as an innovator, able to find “entirely new combinations of resources” (p. 83). Therefore, when

extrapolated to learning in higher education, this concept can be used to highlight the need for students to reinvent their mindset and to find innovative ways to combine new technologies and or resources to aid in their learning. This has never been more evident than the debacle caused by the COVID-19 Pandemic outbreak, which disrupted all areas of education and forced institutions to change their instructional modalities, literally overnight. COVID-19 effectively eliminated the choice of attending classes in person and entire student populations migrated to online learning. Courses were moved to virtual digital platforms, such as Zoom, Microsoft Teams, Collaborate Ultra, 3P Learning, Google Classroom, and Webex (Kelani et. al, 2021).

The Student Entrepreneurial Mindset

Literature on the entrepreneurial mindset in higher education, which focuses on the perspectives of art and science, cognition, etc., draws from studies on entrepreneurialism, which according to Shane and Venkataraman (2000) requires a framework for exploring the many questions related to this important field of study. The area is the main genre on which this study is based and relates to an adoption of the concepts of personality traits of students developing an entrepreneurial mindset model characteristics they can use depending on their program of study. Students in business and engineering education who plan to become entrepreneurs and the programs, courses, and curriculums which are available to facilitate those objectives are the focus of scholars such as: Carsrud and Brännback, (2009); Drucker, (1985 and 2005); Ireland et al., (2003), and McGrath and MacMillan (2000). Their studies on the perspectives of art, science, cognition, relates to entrepreneurs' ability to sense, act, or mobilize under uncertain conditions; to clearly think about and define one's own learning goals, even in times of uncertainty to advance successes in higher education. In 2013, the US Department of Commerce highlighted the ways in which higher education organizations are configuring their programs to promote graduates becoming entrepreneurs. Additionally, in 2021 the AACSB International, business schools worldwide were adding to their entrepreneurship offerings even before the pandemic. For example, the number of undergraduate-level programs in this discipline increased by 23.75% between 2017–2018 and 2019–2020. Schools in Northern Europe and North America represented the largest share of this growth. Vincenzo Esposito Vinzi, Dean and President of ESSEC Business School in France, said, "Students realize that creating their own businesses or joining young and agile companies can provide significant opportunities to shape the world and solve environmental and social problems."

Accordingly, promoting such entrepreneurialism and developing an entrepreneurial mindset while students are considered vital for business success. Thus, it would support the premise that business students would have a higher need to develop their entrepreneurialism mindset characteristics. Consequently, scholars have studied the initiatives higher education engages in to promote entrepreneurialism as a career path and venture for students who matriculate from their programs and on the entrepreneurial learning process, which correlates to such a mindset. It is based on the premise that students, faculty, and administrators—as stakeholders—are integral to the overall success of students in higher education (Deakins and Freel, 1998; Politis, 2005; Rae and Carswell, 2000, 2001). Additionally, research into entrepreneurship has also focused on personality and psychological characteristics and cognition possessed by an individual and how that may translate to becoming an entrepreneur as a career path. For example, Haynie, Shepherd, Mosakowski, and Earley noted the cognitive approach may be defined "simply as the ability to be dynamic, flexible, and self-regulating in one's cognitions given dynamic and uncertain task or environments" (2010, p. 218) and that adaptable cognitions are important in achieving desirable outcomes from entrepreneurial actions. Fiske and Taylor (1991) acknowledged their reliance on social cognition literature to describe the entrepreneur as a motivated tactician, representative of "a fully engaged thinker who has multiple cognitive strategies available, and chooses among them based on goals, motives, and needs" (p. 13) to act (or not) in response to perceived opportunities (McMullen and Shepherd, 2006).

Their study is bolstered by other scholars who note similar characteristics displayed by entrepreneurial mindsets. Neneh (2012) conducted a study to understand the level of the entrepreneurial mindset among entrepreneurs owning small and medium enterprises (SME) in South Africa. The author contends that the lack of an entrepreneurial mindset contributes to the high failure rate of SMEs in South Africa. Moreover, they established that business entrepreneurs with an entrepreneurial mindset performed better in certain aspects of entrepreneurial attributes—creativity, risk-taking propensity, growth mindset etc. McGrath and MacMillan (2000) suggested people with

entrepreneurial mindsets have five common characteristics. They (1) pursue new opportunities; (2) pursue opportunities with enormous discipline; (3) pursue only the best opportunities; (4) focus on execution, and (5) engage the energies of everyone in their organizations. Thus, we posit the focus of the entrepreneurial mindset includes characteristics, which enable students to engage in learning leading to their success, as opposed to those who do not possess such characteristics.

Social Entrepreneurial Learning Process

The second area can be situated in social entrepreneurship, which espouses related concepts to enhance teaching and learning efforts in education. The term social entrepreneurship often refers to the efficient models, which organizations have created to cater to the basic human needs, which existing markets and institutions have failed to satisfy. According to Stephenson (2010), “social entrepreneurship combines the resourcefulness of traditional entrepreneurship with a social mission to change society” (p.448). Stephenson also asserts,

social entrepreneurship offers insights that may stimulate ideas for more socially acceptable and sustainable business strategies and organizational forms. For example, a trend of using entrepreneurship to inform a particular style of management and personal attitude (Sheffield, 1988) that are not primarily motivated by individual profit, but by a social mission (Alder and Kwon, 2003), essentially, to make a positive social change. This contrasts with the popular stereotype of entrepreneurship and shows a relationship with civic and community needs. Thus, managers who use entrepreneurship in a way that is philosophically based on developing the community achieve outcomes for the good of the society (p. 448)

In this context, attention is paid to a culture of change in policy and bureaucracies related to organizations (McLendon, Heller and Young, 2005; Pincus, 1974). Innovation and change rely on policy changes and quality in education as well as cost savings regarding new products and services (Claudet, 1999; Everhart and Doyle, 1980; Havelock and Zlotolow, 1995; Johnson, 2005; Leydens and Schneider, 2013). “This is indicative of the many proponents of social entrepreneurship and innovating efforts by education, business, and other organizations” (Stephenson, 2010, p. 448). It contributes directly to internationally recognized sustainable development goals.

Further, social entrepreneurship and innovation may also encourage established education organizations to take on greater social responsibility. For example, Shinnar, Pruett and Toney (2009) investigated student and faculty attitudes toward entrepreneurship and entrepreneurship education. They found that (a) student and faculty views on entrepreneurship often differ dramatically, particularly in terms of students’ occupational aspirations; (b) interest among nonbusiness students suggests a significant opportunity to formally expand entrepreneurship-related education beyond the business school. Jordan, Fry, and Van Treuren (2016) proffered a best practice piece, which illustrated their Kern Entrepreneurial Engineering Network (KEEN) programs and curriculum to improve graduates’ capabilities, by helping them develop an entrepreneurial mindset. They revealed that 20 universities are also trying to foster such programs. Other studies, for example, Elenurm (2012), Gürol and Atsan (2006), Pihie and Bagheri (2010), and Zhang, Duysters, and Cloudt (2014) also focused on how students feel about entrepreneurship education. Others such as, Hockerts (2018) in his study of students indicate that students’ entrepreneurial intentions can be formed because of social entrepreneurship education.

The Entrepreneurial Mindset in Higher Education Programs

Scholars such as Fry and Jordan (2011) described efforts to introduce the entrepreneurial mindset to undergraduate engineering students at Baylor University, primarily through a program of faculty transformation. Additionally, Jin, Gilmartin, Sheppard, and Chen (2015) focused their study on how higher education institutions can design their programs when they understand how engineering and business students pursue their career choices, based on personality traits and characteristics. The authors used survey data to compare engineering and business students’ entrepreneurial intent. They found personal characteristic measures suggest that engineering and business students are similar in many developmental traits and may have traction in helping to explain entrepreneurial

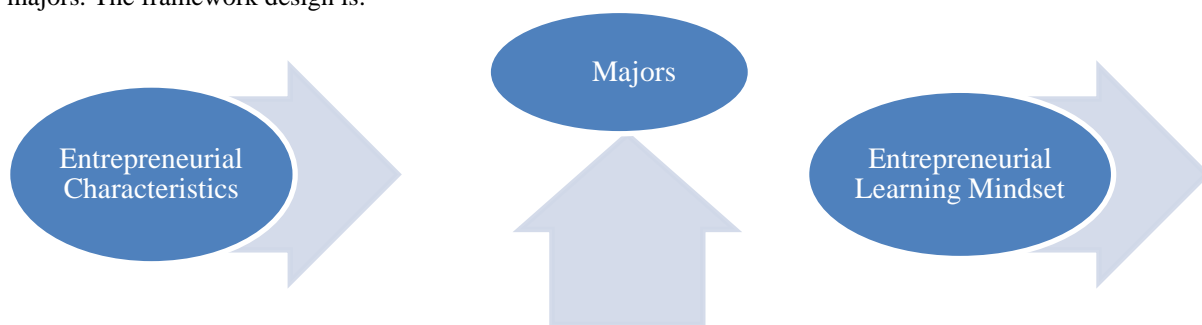
behaviors. They suggest insignificant differences favoring business students are observed on traits such as, innovation orientation, the way they optimize their goals, seeking status, and seeking control over others. They note, "Compared with their counterparts in business, engineering students also rated themselves less positively on several personal characteristics that are related to entrepreneurship, have less interaction with mentors, and have been less involved in entrepreneurship activities and extra-curricular activities" (p.1). Gilmartin, et al. (2019) used a survey and a regression model analysis to explore individual and contextual predictors of entrepreneurial intent (EI)—personal importance that students ascribe to starting a new business, among undergraduate women and men in engineering and business majors. They found that innovation orientation and participation in entrepreneurship activities correlated more strongly for engineering students than for business students, but novel goals to intent were more strongly indicated in business students.

Nabi, Holden, and Walmsley (2010) surveyed students about their entrepreneurial intentions (EI), based on an adoption of Luthie and Franke 2003 model. Their study established three key outcomes: (1) across all years of the survey, a substantial minority of students consistently hold relatively strong start-up intentions; (2) despite considerable efforts to increase the numbers moving to start-up, little impact is discernible, and (3) although the EI survey is useful as a stock taking exercise, it fails to address critical questions about the impact of higher education on entrepreneurship and the transition from entrepreneurial intent to the act of venture creation.

Jung and Lee (2020) advocated for entrepreneurship education to be implemented based on evidence and validity assessments of a change in students' entrepreneurial mindset. Therefore, their study aimed to provide evidence and validity to the College Students' Entrepreneurial Mindset Scale (CS-EMS), by (1) providing measurement invariance of the CS-EMS; (2) comparing the latent and observed means across groups based on gender, major, and educational experiences, and (3) investigating the conditional effects of those three grouping variables. Using data from Korean college students' survey responses, they conducted sequential tests of factorial invariance, latent mean factor analysis, and structural equation modeling. Their results suggest that strict invariance held for the groups compared by either gender or educational experiences, while scalar invariance held between the engineering and non-engineering groups. The results of the conditional effects of grouping variables suggest that educational experiences mattered more than gender or major. The authors note one practical implication for educators is that CS-EMS is a promising assessment tool for addressing the effectiveness of entrepreneurship education. Other scholars have explored similar issues related to EI, see for example, Boldureanu et al. (2013), or Küttim, Kallaste, Venesaar, and Kiisb (2014). Additionally, researchers have focused on absorptive capacity, creativity, and self-determination of the entrepreneur. For example, Chen, Tseng, and Teng, (2019) validates the notion that the entrepreneur is one who recognizes change, brings opportunities rather than threats, reacts to change proactively rather than reactively, and energetically fosters creativity beyond the classroom (Brown and Cornwall, 2000).

Conceptual Framework

The above is a synopsis of the vast amount of literature on the concept of the entrepreneurial mindset; it is used as a basis for developing the conceptual framework and overarching assumptions for this study that entrepreneurial characteristics are applicable to undergraduate students' success in learning but is mediated by their academic majors. The framework design is:



Therefore, to help students succeed in learning, faculty and administration must have similar mindsets. Drucker (1985 and 2005) developed the following conceptual framework regarding entrepreneurial mindset:

- Entrepreneurial mindsets begin with personal initiatives—taking personal responsibility for the learning environment.
- Entrepreneurs need to search purposefully for sources of education and learning which can create lasting change and apply the principles of successful innovation.
- Entrepreneurship is attitude and behavior rather than personality trait; its foundation lies in concept and theory rather than intuition.
- Everyone who is faced with making any decision can learn to be an entrepreneur and to behave entrepreneurially.
- They will display a mindset poised for improving the quality of their learning.

The conceptual framework and hypotheses guiding this study are based on an extrapolation of Drucker's Model characteristics of the entrepreneurial mindset. The authors developed characteristics based on a categorical framework of how students may perceive and develop their entrepreneurial learning mindset, from personal initiatives to timing. This model is not dated; it posits that each of us must be prepared to lead in this new world of globalism and sustainability requirements. Thus, we must portray discipline and begin to ask questions and engage in context and with people who can help us master the art or science of learning entrepreneurially and from a perspective of growth.

Hypotheses Development

Students' entrepreneurial mindset, the dependent variable, is based on the characteristics of entrepreneurialism, the independent variables, which are extrapolated from Drucker, 1985 and 2005 Model. These characteristics comprise the attributes of the three main underpinnings of the entrepreneurialism mindset offered in the literature and used to develop the survey, hypotheses, and assumptions guiding the study:

1. Classical: Venture capitalism, personal initiatives, opportunities, and preferences
2. Social: Personality traits, curiosity, creativity, positive attitude
3. Learning context: Institution, department, program, and instructor.

In measuring personal characteristic of entrepreneurial intention, Jin, et al. (2013) suggest engineering and business students are similar in entrepreneurial developmental traits, but that they observed small differences favoring business students on traits such as innovation orientation, optimization of their seeking status, and seeking control over others. Nabi, Holden, and Walmsley (2010) concluded that students studying engineering and technology are less likely than business students to hold entrepreneurial intentions due to the concentration of enterprise and entrepreneurship activity within business schools. They further implied science and social science students are least likely to show interest in entrepreneurial intentions. Mohammed (2012) implies engineers make the best entrepreneur and espouses that the current trend for engineering students is to graduate and start their own firms. However, Zwilling (2012) implies it is a big step for engineering students to become entrepreneurs, but that they possess the skills required of an entrepreneur.

Hypotheses

H₀: Academic majors have no statistical significance or correlations to the attributes (characteristics) students adopt in developing their entrepreneurial learning mindsets.

H₁: Accounting, and business majors will embrace and develop attributes related to the classical characteristics of an entrepreneurial learning mindset, than will engineering and architecture or information technology and computer science in their institutions of higher learning.

H₂: Engineering, and architecture and majors, will embrace and develop attributes related to the social characteristics of an entrepreneurial learning mindset, than will accounting and business in their institution of higher learning.

H₃: Information technology and computer sciences majors will embrace and develop the social characteristics of an entrepreneurial learning mindset, than will accounting and business in their institution of higher learning.

H₄: Students who have an entrepreneurial learning mindset recognize the importance of the entrepreneurial minded learning context in which they learn.

Table 1 demonstrates the characteristics framework, which was adopted to create conceptual models for each major in this study. Additionally, the ELMCM framework in Figure 1 is the basis for the Models proposed for each major and are outlined in the result and discussion sections.

Methodology

The research was designed as a prediction study as referenced in Fraenkel, Wallen, and Hyun's (1993) education research. The goal was to determine variables related to a specific criterion variable. The dependent variable was the entrepreneurial learning mindsets of students majoring in different majors across three colleges of a university. Predictive validity (evidence of) score results from the survey instrument can predict the characteristic of the entrepreneurial learning mindset and how such a mindset influences students' learning. The study was conducted in two phases, a pilot study followed by the primary study.

Participants and Method

One of the authors had an interest in this subject for years; therefore, upon review of the literature, to see where we could situate this study, we decided to focus on understanding how students majoring in different career fields would define their entrepreneurial characteristics. In doing so, our goal was to create model characteristics for each major by determining the most significant entrepreneurial characteristics, which faculty and administration should help students develop. The participating students were N= 167/198 (84%) enrolled in courses within the three colleges, including 1) accounting and business 2) engineering and architecture, and 3) information technology and computer science. Specifically, the seven undergraduate courses, included accounting, business law, economics, and management. They were given information about the study and asked to participate but were not compensated for participation.

Instrument, Data Collection, and Analysis

Primary instrument was a qualitative survey developed over, one year, using a combination of original questions (by the authors) and questions extrapolated from *Entrepreneurial Mindset Tool*, developed by (Collura and Applegate, 2000 and 2001). An initial pilot study was also conducted to test the efficacy of the survey using a sample of 20 students at a major university. The pilot surveys were analyzed, and the results presented at an annual scholarship of teaching conference. Responses from the pilot surveys and feedback questions from the conference attendees were used to modify the questions. The final survey was designed using an interactive word document and was uploaded to the seven courses' websites for several weeks during the 2018-2019 academic year. This data collection method ensured easy access to the survey. Students could complete it anonymously and on their own time, while enabling them to be frank and authentic with their responses (Cooper and Schindler, 2006). Students were asked to identify their year level, major, and to respond to questions related to entrepreneurial characteristics related to their learning.

The survey was divided into 10 categories (labeled, C1-10) and consisted of multiple parts and or questions, thus resulting in 49 questions and statements. Likert scaled responses were used to determine how students perceived the attributes and characteristics of the entrepreneurial mindset on their learning abilities, as well as the way an

entrepreneurial minded faculty, programs, etc. contributes to their learning. See Appendix 2 for details of each item in the survey. The synopsis of the categories of the characteristic follows:

- C1 and C2 relate to demographic questions, academic majors, and ranks.
- C3-C9 includes the categories for the Characteristics of the Entrepreneurial Learning Mindset Model are outlined in Table 1:
- C10 is an open-ended area for students to offer additional information they deemed appropriate.

The data were analyzed based on majors using the statistical tools in IBM SPSS, Version 24. Various statistical analyses were performed, and models developed including descriptive statistics; the general linear model, and MANOVA. Other multivariate tests—Pillai's Trace, Wilks' Lambda, Hotelling's Trace, Roy's Largest Root, Box's Test of Equality of Covariance Matrices, and Levene's Test of Equality of Error Variance were used to test for errors and bias in the data. Mean, standard deviations, mean square, *R* square, and *P*-values, indicating statistical significance were calculated. The confidence of statistical significance we have in our findings are supported by the results of Box's, Roy's, and other Multivariate tests of covariances. The Box's Matrices checks the assumption of homogeneity of covariance across the groups with results sig = .000 indicating there are significant differences between the covariance matrices. The one-way MANOVA was also statistically significant, as indicated in the results of sig = .000, which means *P*-values < .0005 (see Tables VII to IX).

Results and Discussions

Aggregated results and discussions are presented considering the conceptual framework and hypotheses tested. Table II outlines the descriptive statistics of participants' academic majors and status. Aggregate statistics of the students' perceptions of the characteristics of entrepreneurial learning mindset based on personality traits, are categorized (C3–C8) and outlined in Tables III and IV, while their perceptions of the learning environment are categorized in C9 and outlined in Tables V and VI. Academic majors are the between subject's mediator variables, while independent variables include characteristics of the ELM the dependent variable. Statistical results including means, standard deviations, *P*-values significance are presented in Tables III and IV. Table III describes the aggregated categorical synopses of the statistical results of all participants *N* = 167, based on a 95% confidence interval and a significance level of *P*-values = .05. Table IV outlines the results of the students' perceptions of the within subjects entrepreneurial learning by major. A discussion of the independent variables, characteristics of entrepreneurial learning mindsets follows the specific discussion on the results in the tables. This discussion includes a comparison of similarities and differences of the findings of this study with previous studies. Tables V and VI and related discussions focus on category 9, the entrepreneurial learning mindset environment.

Table 2 shows *N*=167 participants in this study were pursuing various majors and were of varying undergraduate status—freshman or sophomore (*n* = 55; 33%), junior (*n* = 66; 40%, 39.5%), and senior (*n* = 46; 27.5%). Freshmen and sophomores are grouped because some noted they were second year but did not have all required credits to be officially classified a sophomore. Likewise, students classified as sophomores are also often first year students, transferring credits from high school. Majors parallel the three colleges at this university: (a) Accounting and business (*n* = 61; 36.5%), (b) Engineering and architecture (*n* = 72; 43.1%), and (c) Information technology and computer science (*n* = 34; 20.4%).

Effect of Entrepreneurial Learning Characteristics (ELC)-All (Groups) Majors

Before highlighting the characteristic model frameworks, this section discusses the aggregated results of all majors of students' perceptions of each of the characteristics in our entrepreneurial learning mindset framework models and how our findings are supported or refuted by some of the studies on entrepreneurial mindsets or intent outlined in the literature review. Cs represent the aggregate categories of the six groups of entrepreneurial characteristics and traits. Table III compares results of overall population groups of participants in this study. The means (\bar{x}), standard deviation for variance (σ^2), and probability significance values (*P*) are displayed. Mean square is also displayed to show the average of errors, bias, and variation in the data; it measures the quality of the estimators. Any errors and

biases in the data analysis are not substantial enough to skew the statistical significance of the means and P -values. Degrees of freedom (df) = 3 are the numbers of independent pieces of information that went into calculating the estimate. The statistic is an upper bound on F that yields a lower bound on the significance level, with values closer to zero being statistically more significant. Therefore, several of the results are statistically significant, indicated with means $\geq 3.0/5.0$ scale and P -values $<.05$. In Table IV, the mean (\bar{x}), standard deviation for variance (s^2), and probability significance values (P) are displayed between each major. The error variances are not included in Table IV since reliability of the results was established for the population sample $N = 167$ students and outlined in Table III. However, additional details on error tests are outlined in Tables VII to IX.

The results suggest students perceive characteristics in category C5—positive attitude, self-confidence, dynamic outlook (\bar{x} 3.23, σ^2 .735, and P .002) and category C6—desires and motivation (\bar{x} 3.19, σ^2 .823, and P .002) are strong characteristic of their entrepreneurial learning abilities. Characteristics in category C7—opportunity and preferences (\bar{x} 1.37, σ^2 .479, and P .001), and category C3—venture capitalist (\bar{x} 2.55, σ^2 .1.000, and P .006) are not strong characteristics of their entrepreneurial learning abilities. Statistically Table IV, between majors effects, supports these findings in Table III. The results suggest that C5—positive attitude, self-confidence, dynamic outlook, and C6—desires and motivation are the two categories, which students perceive are the characteristics traits, which are central to developing an entrepreneurial mindset across all three majors. The opposite is true for C7—opportunity and preferences, which students perceive are the least important characteristics needed to develop the entrepreneurial mindset. Results of the one-way MANOVA indicate there was statistically significant differences in student majors based on entrepreneurial abilities, $F(138, 339.572) = 1.589$, $P < .0005$; Wilk's $\Lambda = 0.225$, partial $\eta^2 = .392$. Additionally, the multivariate = .392 indicates that approximately 39% of multivariate variance of the dependent variables is associated with the group factor (see Table VIII). A nuanced discussion of the results of the characteristics (independent variables) affecting the majors' comparison are expounded on in the paragraphs below. Levene's Test supports the reliability we have in the results based on how the characteristics were grouped in each category (see Table IX).

C3—Venture capitalism

This category includes classical concepts of entrepreneurialism such as being a venture capitalist, owning a business, and influencing one's destiny. Drucker relates this category to taking personal initiative. Students disagreed, that an entrepreneurial learning mindset includes characteristics related to the traditional or classical approaches to entrepreneurialism. This result is statistically significant with aggregated mean = 2.55 and P -values = .006. When analyzed between majors, results show engineering and architecture majors showed the most statistically significant agreement to the classical concept of entrepreneurialism, as an entrepreneurial learning mindset with mean = 2.74 and P -values = .053. Our findings are:

- » Supported by Gilmartin et al. (2019). They found innovative behaviors were strongly related to entrepreneurial intent in both business and engineering fields but more predictive of intent in engineering.
- » Refuted by Jin, et al. (2015). They note that in explaining entrepreneurial behaviors, small differences favoring business students are observed on traits such as, innovation orientation.

C4—Curiosity, creativity, etc.

For this category, students agreed personality traits such as curiosity, creativity, effectiveness, problem-solving, and being action oriented, are indicative of an entrepreneurial learning mindset. The overall statistic means = 3.11 with P -values = 0.25. When analyzed between majors, engineering and architecture majors mean = 3.44 and P -values = .032 was statistically significant. Our findings are:

- » Supported by Jung and Lee (2020). They indicated in their study of entrepreneurial mindset based on gender, majors, and educational experiences, that engineering majors had significantly higher latent means for similar characteristic, but specifically innovativeness.

C5—Attitudes and motives

Students agreed that positive attitudes, confidence, and a dynamic outlook for the future are applicable to an entrepreneurial learning mindset. Means = 3.23 and P -values = .002 indicate statistical significance. Within accounting and business majors mean = 3.22 and P -values = .002 agreed most significantly that attitudes and motives, such as confidence, are important for an entrepreneurial minded students' attitude to learning. Our findings are:

- » Supported by Gilmartin et al. (2019). They question whether attitudes and motives, such as persistence, as an entrepreneurial trait are compatible to engineer majors' entrepreneurial intent.

C6—Desires and motivation

Students agreed desires and motivation to accomplish, advance, or prove themselves are important to an entrepreneurial learning mindset. The mean = 3.19 and P -values = .002 were statistically significant. For accounting and business majors, mean = 3.24; P -values = .022 and engineering and architecture mean = 3.26 and P -values = .027 agreed most significantly that entrepreneurial learning displays desires and motivation to accomplish and advance oneself. Our findings are:

- » Refuted by Jung and Lee (2020). They indicated students' majors, did not have a significant effect on their scores in similar subscales (characteristics) needed for achievement.

C7—Opportunities and preferences

Having the ability to spot and catch more opportunities and preferences related to self-determination in pursuing classwork and preferences for pursuing several courses showed some very surprising and statistically significant results. Characteristics in this category related to opportunities and preferences are negatively correlated to all majors. The mean = 1.37; P -values = 0.001, indicates overall, students disagreed, that these opportunities and preferences are characteristics of an entrepreneurial learning mindset. This disagreement was statistically significant for accounting and business majors mean = 1.44 and P -values = 0.005. Does this indicate accounting students are not eager nor willingness to focus on opportunities and preferences? While our findings are somewhat:

- » Supported by Jung and Lee (2020) they note that engineering students scored higher on proactiveness than the business students.

This characteristic does not correlate well to the development of engineering and architecture students' mindset nor information and technology majors; hence, to none of these majors.

C8—Ability to involve others

Overall results showed students disagreed, with some significance, that involving others in decision-making is a necessary characteristic of an entrepreneurial learning mindset mean = 2.73; P -values = 0.24. This overall finding was surprising since the extant literature highlights the concept of involving others as an entrepreneurial characteristic. The exception was highlighted between majors, with the accounting and business mean = 3.07 and P -values = 0.031. They agreed significantly that entrepreneurial learning mindset involves others in decision-making, etc. Our findings:

- » Mirrors those of Jung and Lee (2020). They found that engineering majors did not score higher than the business majors in the autonomy sub-construct of their *College Students' Entrepreneurial Mindset Scale* (CS-EMS) study.

Overall, the above discussions show our study is supported or refuted by findings of previous studies focusing on entrepreneurialism broadly defined. These confirmations or contradictions are possibly due to differences in participants, methodologies, and purpose of prior studies, most of which were narrowly focused on entrepreneurial intent or innovations related to owning a business.

Majors Entrepreneurial Learning Mindset Models (ELMM)

Based on the findings in our analyses, we rejected the null hypothesis and constructed the three majors' entrepreneurial learning mindset model (ELMM) and the core framework previously illustrated in Figure 1. These ELMMs are proposed to measure the relationship of the independent variables to the dependent variable for each major. The models emphasize characteristics that correlate the most to the majors, indicated by the statistical evidence outlined in Table IV and discussed in the prior section.

Accounting and Business Majors-ELMM

H₁: Accounting, and business majors will embrace and develop attributes related to the classical characteristics of an entrepreneurial learning mindset, than will engineering and architecture or information technology and computer science in their institutions of higher learning.

This section addresses Hypothesis 1. Drucker's Model reveals that personal initiative are entrepreneurial characteristics related to developing venture capitalism and business initiatives. Therefore, we hypothesized that accounting and business students would perceive those characteristics as having an impact on their learning mindset. This hypothesis was not strongly supported. The model in Figure 2 shows the best combination of the characteristics for accounting and business students. Characteristics in category C3—venture capitalism (\bar{x} 2.65, s^2 .831, P .025); category C7—opportunities & preferences (\bar{x} 1.44, s^2 .507, P .005) are not strongly correlated to the accounting and business students learning mindset. Rather, category C5—positive attitudes (\bar{x} 3.22, s^2 .799, P .002); Category C6—desires & motivations (\bar{x} 3.24, s^2 .816, P .022); C8—confidence & trust, etc. (\bar{x} 3.07, s^2 .923, P .031), are the most statistically significant characteristics which students perceive help define their entrepreneurial learning mindset.

Engineering, Architecture, and Construction Majors-ELMM

H₂: Engineering, and architecture and majors, will embrace and develop attributes related to the social characteristics of an entrepreneurial learning mindset, than will accounting and business in their institution of higher learning.

This section addresses Hypothesis 2. Drucker's Model reveals that entrepreneurship is attitude and behavior rather than personality trait and that entrepreneurialism require engaging in context and with people who can help us learn. Therefore, we hypothesized that non-accounting and business majors in this study would perceive those related characteristics as having an impact on their learning mindset. This hypothesis was not strongly supported. Rather, the model in Figure 3 shows the best combination of the characteristics for engineering and architectural majors are category C4—personality traits (\bar{x} 3.44, s^2 .797, P .032); category C5—positive attitudes (\bar{x} 3.22, s^2 .696, P .043); category C6—desires & motivations (\bar{x} 3.26, s^2 .805, P .027), which are strongly correlated to the engineering and architecture students' learning mindset. Category—C7, opportunities and preferences (\bar{x} 1.35, s^2 .479, P .008) are not strongly correlated to these students' learning mindset.

Information Technology and Computer Science Majors-ELMM

H₃: Information technology and computer sciences majors will embrace and develop the social characteristics of an entrepreneurial learning mindset, than will accounting and business in their institution of higher learning.

This section addresses Hypothesis 3. This assertion that information technology and computer science majors will be more inclined to adopt and develop the social characteristics related to an entrepreneurial learning mindset was not strongly supported. Figure 4 shows characteristics in category C4—personality traits (\bar{x} 3.21 s^2 .764, and P -.137); category C5—including positive attitudes (\bar{x} 3.27, s^2 .792, and P .123), and category C6—desires and motivations (\bar{x} 3.15, s^2 .787, and P .071), are strongly correlated to the information technology and computer science students

learning mindset. Category C7—opportunities & preferences (\bar{x} 1.71, s^2 .454, P .024) are not strongly correlated to these students' learning mindset.

C9—Measurement of Entrepreneurial Mindset Learning Context

H4: Students who have an entrepreneurial learning mindset recognize the importance of the entrepreneurial minded learning context in which they learn.

Category C9 depicting the entrepreneurial learning context, is important because the environment in which students are learning may advance or disadvantage their learning mindset. This section addresses Hypothesis 4. Tables V and VI Aggregate results show students' attitudes toward an entrepreneurial learning context, which they believe will be quality learning. We offer a discussion on how the results of our study contradict or agree with those of previous studies, which include similar attributes. The results show statistical significance that students agree that entrepreneurial learning contexts must be coupled with strategy and constant inquiry mean = 3.32; P -values = 0.002. Agreeing that an entrepreneurial learning context is innovative and should be by association, mean = 3.32; P -values = 0.008, is also statistically significant. Systematic, purposeful, and disciplined entrepreneurial learning contexts mean = 3.37; P -values = 0.39 are important to students. They also agreed it is never too late to create an entrepreneurial learning mindset in which quality learning will occur mean = 3.45; P -values = 0.009. Students agreed, entrepreneurial learning contexts create an attitude of lasting change in which quality learning can occur mean = 3.23; P -values = 0.052.

Attitudes toward an entrepreneurial learning context within which students believe quality learning will occur, is most statistically significant for the concepts related to entrepreneurial learning being systematic, purposeful, and disciplined. Table VI shows within subject results and demonstrates H4 was not supported, significantly, by all majors. For example, engineering and architecture mean = 3.19; P -values = 0.005 and information and computer science mean = 3.58; P -values = 0.000 majors agreed significantly with these concepts, while accounting and business students did not find these contexts significant.

Entrepreneurial learning coupled with strategy and inquiry was significant for information and computer science mean = 3.58; P -values = 0.002. engineering and architecture majors perceived, significantly, that entrepreneurial learning created an attitude of lasting change mean = 3.26; P -values = 0.005. information and computer science mean = 3.53; P -values = 0.002 and accounting and business majors mean = 3.37; P -values = 0.026 conclusion that it is never too late to create an entrepreneurial learning mindset was the most statistically significant. Our study shows that students have strong perceptions that their learning environment should also pursue such entrepreneurial mindsets; therefore, we benchmark our results with previous studies. This finding is supported by previous studies such as Jordan, Fry, and Treuren (2016). They demonstrated a best practice approach based on a group of 20 universities seeking to improve graduates' capabilities by helping them develop an entrepreneurial mindset while they are students. They defined entrepreneurial mindset as characterized by students' actions related to:

1. Demonstrating curiosity and exploring solutions
2. Connecting and integrating information from many resources while assessing and managing risks
3. Creating value by identifying opportunities and persisting through failure.

While technical knowledge is essential to engineers, the authors posit that they will find success and personal fulfillment when they couple these skills with an entrepreneurial mindset to create extraordinary value for others. They outlined the strategies for meeting this goal through faculty development and implementing programs and curricula related to entrepreneurialism. Additionally, Jung and Lee (2020) indicated their findings support the premise that entrepreneurship education is an important factor for building an entrepreneurial mindset. They concluded that entrepreneurially oriented educational programs might enable students to obtain the attitudes needed to gain practical experience and have a positive impact on students' entrepreneurial intentions.

Conclusions and Implications

This study discusses students' perceptions of the characteristics of an entrepreneurial learning mindset and used those characteristics to develop an ELM Model Characteristic framework for several majors. Our main conclusions are:

- Accounting and business majors agreed most significantly characteristics such as confidence, a dynamic outlook etc., are important for an entrepreneurial minded student's attitude to learning. This finding is surprising, because as outlined in the literature some studies, for example, Gilmartin, et al. (2019) suggest novel goals to intent were more strongly indicated in business students. Hence, should conform to the classical characteristics of entrepreneurialism, such as venture capitalism.
- Engineering and architecture, majors agreed that classical characteristics of entrepreneurialism, such as venture capitalism, owning one's own business, and influencing one's destiny, are most applicable. Could the practical implications be that engineers are more risk tolerant, or is it because of their creative outlook?
- Information technology and computer science majors agreed that personality traits such as positive attitudes, and desires and motivations are important for developing an entrepreneurial learning mindset.
- We also found that characteristics in the category related to opportunities and preferences are negatively correlated to all majors. This is surprising and statistically significant for accounting and business majors. Does this indicate accounting students are not eager nor willingness to focus on opportunities and preferences?

Our study also finds students' perception of entrepreneurial learning is contextual and requires the assistance of faculty, programs, and institutions. They proffer students, faculty, and administrators, as stakeholders, are integral to their overall success in higher education and to the *mission* of the institution. They perceive three contextual principles are necessary for them to develop and to practice using their entrepreneurial learning mindset. These contextual principles are:

- (a) purposeful, disciplined, and systematic learning context
- (b) innovative learning context
- (c) strategy-based learning context.

Information technology and accounting and business majors concluded that it is never too late to create an entrepreneurial learning mindset. Hence, the study contributes to the knowledge base in the social-entrepreneurial sphere and literature. Specifically, when students develop an entrepreneurial learning mindset by building on the characteristics outlined in our framework, they can pursue quality education and succeed if faculty and administration implement entrepreneurial-minded contexts—institution, department, program, and instructors in which they learn. We contend that most of the prior studies discussed were conducted in general comprehensive universities, while our study was conducted at a polytechnical university. Those studies focused on the concept of the mindset or intent but not how characteristics relate to students' learning mindset. Therefore, future studies could focus on the quality of learning that students gain if they use their entrepreneurial learning mindset coupled with their university support. Additionally, future studies could focus on the rationale related to the two questions posed about opportunities and preference of accounting majors vs. the risk tolerance of engineering majors. We acknowledge two limitations of comparison among the groups in the study and propose these could be measured in a future study and or article (1) we did not assess gender or age in the survey, (2) although we analyzed the students' academic status, we did not focus the manuscript on this independent variable our focus was on comparing majors leading to career choices. This was to refute the previous findings in the literature as related to our hypotheses.

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Appendix I-Figures & Tables

Table I. Characteristics of Entrepreneurial Learning Mindset Model

| Drucker's Entrepreneurial Characteristics | Survey Categories C1 to C9 | Entrepreneurial Learning Mindset Detail Characteristics for this Study: |
|--|----------------------------|---|
| Personal initiative | C3 & C4 | Venture capitalism: own franchise, own business, innovation. |
| Entrepreneurship is attitude and behavior rather than personality trait | C5 & C6 | Personality traits: curious, creative, effective, problem-solver, action-oriented, etc. Positive attitude: self-confidence, confidence in future, dynamic outlook, desires, and motivation to accomplish, advance, prove, etc. |
| Engage in context and with people who can help us learn | C7 & C8 | Opportunities & preferences: creation of new means-ends and profitability-oriented, risk tolerance, etc. Confidence & Trust: confidence, trust, ability to involve others |
| Opportunities to create lasting change Everyone who is faced with making any decision can learn to be an entrepreneur and to behave entrepreneurially | C9 | Entrepreneurial learning: systematic, strategic, and innovative Entrepreneurial learning: creates an attitude of lasting change Entrepreneurial learning mindset: Never too late to create it |

Table II. Participants' Academic Majors and Ranks

| Demographics Between-All Majors Academic Results: C1-Ranks and C2-Majors Mediator Variable–Majors N % | | | Freshman/ Sophomore | Junior | Senior |
|--|------------|------------|--------------------------------|---------------|---------------|
| Accounting and business | 61 | 36.5 | 25 (41%) | 17 (28%) | 19 (31%) |
| Engineering and architecture | 72 | 43.1 | 15 (21%) | 42 (58%) | 15 (21%) |
| Information technology and computer science | 34 | 20.4 | 15 (44%) | 7 (21%) | 12 (35%) |
| Totals | 167 | 100 | 55 | 66 | 46 |

Figure 1. The Entrepreneurial Learning Mindset Characteristic Models (ELMCM)

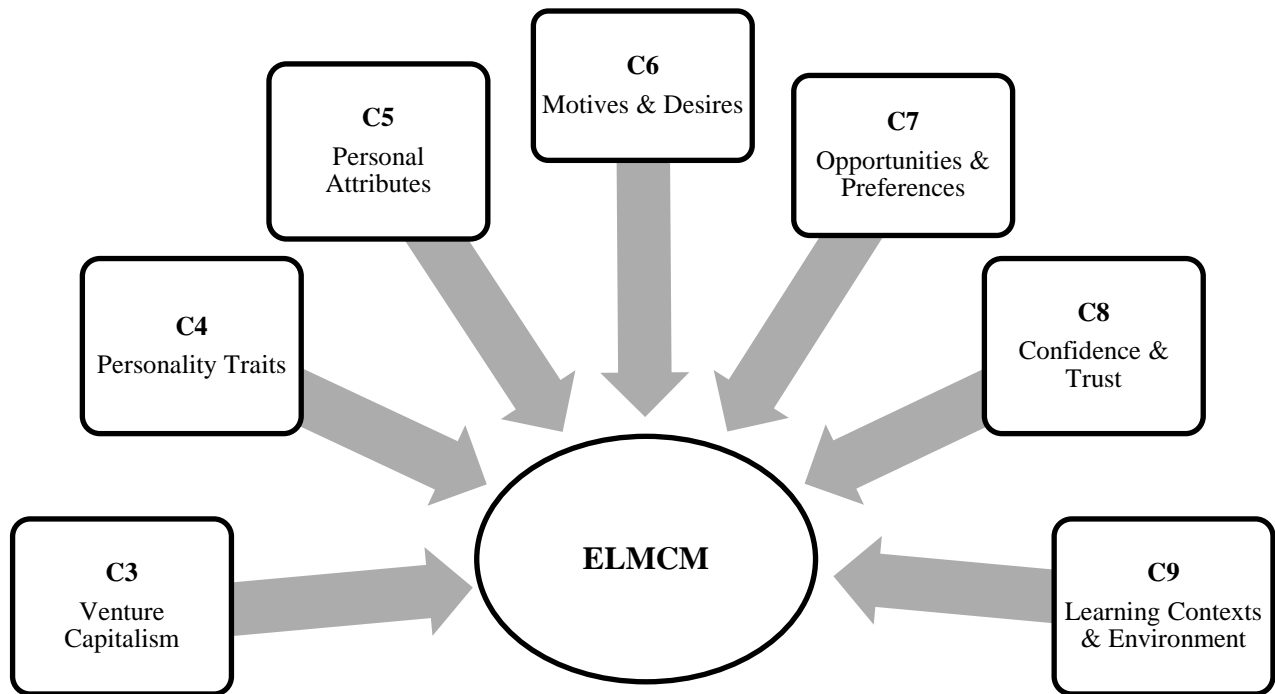


Table III. Aggregated Results-ALL Majors

| Cs | Characteristics of Entrepreneurial Learning Mindset Independent Variables | Mean \bar{x} | Std. Deviation for variance σ^2 | Mean Square | F | Partial r Square correlations | P-values (sig.) * |
|-----------|--|----------------|--|-------------|------|-------------------------------|-------------------|
| C3 | Venture capitalism | 2.55 | 1.000 | .301 | .315 | .813 | .006 |
| C4 | Personality traits-curious, creative, effective, problem-solver, action oriented, etc. | 3.11 | .769 | .346 | .080 | .874 | .025 |
| C5 | Positive attitude and self-confidence; dynamic outlook | 3.23 | .735 | .054 | .088 | .967 | .002 |
| C6 | Desires and motivation to accomplish, advance, etc. | 3.19 | .823 | .076 | .106 | .957 | .002 |
| C7 | Opportunity and preferences | 1.37 | .479 | .008 | .039 | .990 | .001 |
| C8 | Confidence and trust-ability or willingness to involve others, etc. | 2.73 | .584 | .787 | .801 | .472 | .024 |

Table IV. Aggregated Results-Majors

| Cs | Characteristics of Entrepreneurial Learning Mindset Independent Variables | Accounting and business n = 61 | Engineering and architecture n = 72 | Information technology and Computer Science n = 34 |
|-----------|--|---|--|---|
| C3 | Venture capitalism | \bar{x} 2.65 s^2 .831 <i>P</i> .025 | \bar{x} 2.74 s^2 .878 <i>P</i> .053 | \bar{x} 2.61 s^2 1.18 <i>P</i> .251 |
| C4 | Personality traits-curious, creative, effective, problem-solver, action oriented, etc. | \bar{x} 2.98 s^2 .675 <i>P</i> .021 | \bar{x} 3.44 s^2 .797 <i>P</i> .032 | \bar{x} 3.21 s^2 .764 <i>P</i> .137 |
| C5 | Positive attitude, self-confidence, dynamic outlook | \bar{x} 3.22 s^2 .799 <i>P</i> .002 | \bar{x} 3.22 s^2 .696 <i>P</i> .043 | \bar{x} 3.27 s^2 .792 <i>P</i> .123 |
| C6 | Desires and motivation to accomplish, advance, etc. | \bar{x} 3.24 s^2 .816 <i>P</i> .022 | \bar{x} 3.26 s^2 .805 <i>P</i> .027 | \bar{x} 3.15 s^2 .787 <i>P</i> .071 |
| C7 | Opportunities and Preferences | \bar{x} 1.44 s^2 .507 <i>P</i> .005 | \bar{x} 1.35 s^2 .479 <i>P</i> .008 | \bar{x} 1.71 s^2 .454 <i>P</i> .024 |
| C8 | Confidence and trust traits-ability or willingness to involve others, etc. | \bar{x} 3.07 s^2 .923 <i>P</i> .031 | \bar{x} 2.81 s^2 .816 <i>P</i> .019 | \bar{x} 2.74 s^2 .548 <i>P</i> .076 |

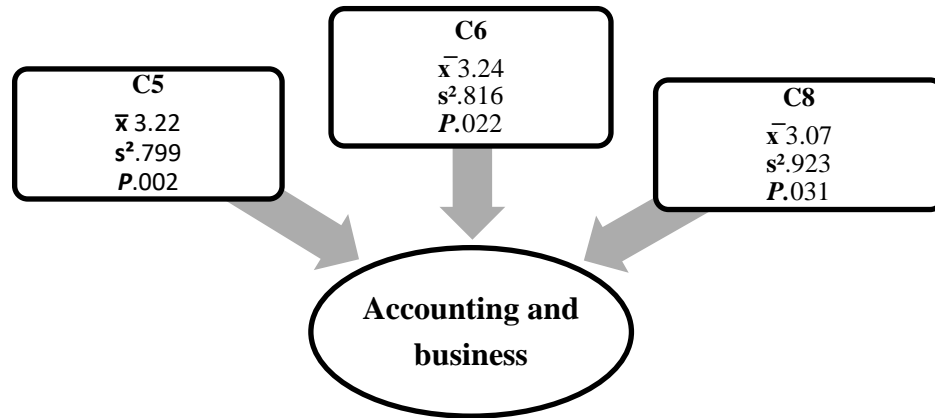
Figure 2. Accounting and Business ELMM

Figure 3. Engineering and Architecture ELMM

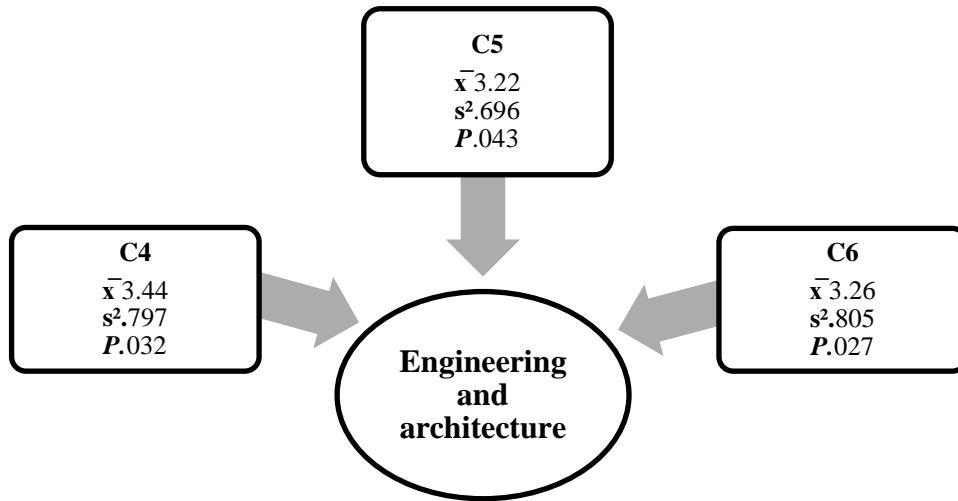


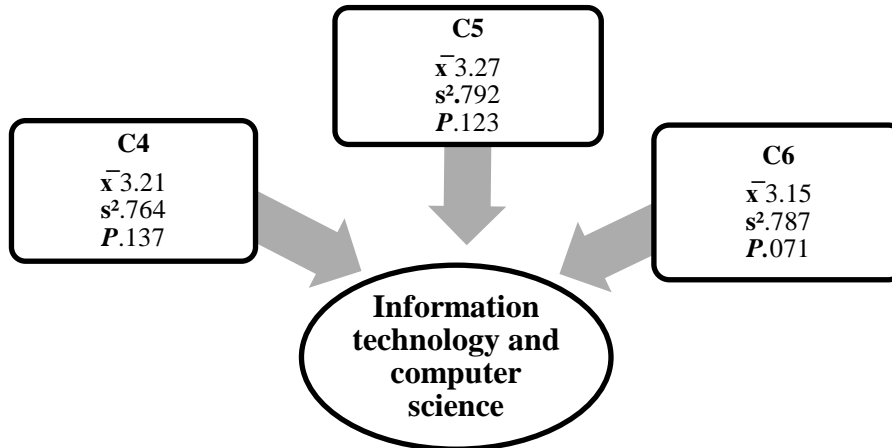
Figure 4. Information Technology and Computer Science ELMM

Table V. Aggregated Results-Learning Contexts

| C_{Sx} | Characteristics of Entrepreneurial Learning Contexts C_{91-5} Independent Variable | Mean \bar{x} | Std. Deviation for variance σ^2 | Mean Square | F | Partial r Square correlations | P -values (sig.) |
|-----------|---|----------------|--|-------------|------|---------------------------------|--------------------|
| C9 | Entrepreneurial learning contexts is systematic, purposeful, and disciplined | 3.37 | .714 | .156 | .148 | .157 | .039 |
| | Entrepreneurial learning contexts is coupled with strategy and constant inquiry | 3.32 | .797 | .063 | .098 | .961 | .002 |
| | Entrepreneurial learning contexts is innovative and by association | 3.32 | .755 | .244 | .417 | .741 | .008 |
| | Entrepreneurial learning contexts creates an attitude of lasting change | 3.23 | .744 | .425 | .626 | .047 | .052 |
| | Never too late to create an "Entrepreneurial learning mindset" | 3.45 | .740 | .264 | .477 | .698 | .009 |

Table VI. Aggregated Results of Tests of Within-Subjects Effects-Majors: Learning Contexts

| C_{Sx} | Characteristics of Entrepreneurial Learning Contexts C9 ₁₋₅ Independent Variable | Accounting/ Business n = 61 | Engineering/ Architecture/ Construction n = 72 | Information Technology/ Computer Science n = 34 |
|----------|--|---|---|---|
| C9 | Entrepreneurial learning contexts is systematic, purposeful, and disciplined | \bar{x} 3.02 s^2 .813 <i>P</i> .030 | \bar{x} 3.19 s^2 .725 <i>P</i> .005 | \bar{x} 3.58 s^2 .612 <i>P</i> .000 |
| | Entrepreneurial learning context is coupled with strategy and constant inquiry | \bar{x} 3.28 s^2 .921 <i>P</i> .082 | \bar{x} 3.10 s^2 .695 <i>P</i> .049 | \bar{x} 3.58 s^2 .668 <i>P</i> .002 |
| | Entrepreneurial learning context is innovative and by association | \bar{x} 3.09 s^2 .714 <i>P</i> .052 | \bar{x} 3.33 s^2 .650 <i>P</i> .038 | \bar{x} 3.42 s^2 .692 <i>P</i> .012 |
| | Entrepreneurial learning contexts creates an attitude of lasting change | \bar{x} 3.28 s^2 .796 <i>P</i> .051 | \bar{x} 3.26 s^2 .628 <i>P</i> .005 | \bar{x} 2.79 s^2 .918 <i>P</i> .068 |
| | Never too late to create an “Entrepreneurial learning mindset” | \bar{x} 3.37 s^2 .879 <i>P</i> .026 | \bar{x} 3.49 s^2 .650 <i>P</i> .049 | \bar{x} 3.53 s^2 .697 <i>P</i> .002 |

Table VII. Error Tests All Between subjects for Majors

| | Box's Test of Equality of Covariance Matrices^a |
|---------|--|
| Box's M | 2174.432 |
| F | 1.202 |
| df1 | 1081 |
| df2 | 42200.085 |
| Sig. | .000 |

The Box's Test of Equality of Covariance Matrices checks the assumption of homogeneity of covariance across the groups using $p < .001$ as a criterion. It is indicating that there are significant differences between the covariance matrices.

Table VIII. Multivariate Tests

| Effect | | Value | F | Hypothesis df | Error df | Sig. | Partial Eta Squared |
|-----------|--------------------|---------|----------------------|---------------|----------|------|---------------------|
| Intercept | Pillai's Trace | .994 | 423.818 ^b | 46.000 | 113.000 | .000 | .994 |
| | Wilks' Lambda | .006 | 423.818 ^b | 46.000 | 113.000 | .000 | .994 |
| | Hotelling's Trace | 172.528 | 423.818 ^b | 46.000 | 113.000 | .000 | .994 |
| | Roy's Largest Root | 172.528 | 423.818 ^b | 46.000 | 113.000 | .000 | .994 |
| C2-Major | Pillai's Trace | 1.170 | 1.598 | 138.000 | 345.000 | .000 | .390 |
| | Wilks' Lambda* | .225 | 1.589 | 138.000 | 339.572 | .000 | .392 |
| | Hotelling's Trace | 1.953 | 1.581 | 138.000 | 335.000 | .000 | .394 |
| | Roy's Largest Root | .849 | 2.123 ^c | 46.000 | 115.000 | .001 | .459 |

*The multivariate = .392 indicates that approximately 39% of multivariate variance of the dependent variables is associated with the group factor.

Table IX. Levene's Test of Equality of Error Variances

| Cs | Characteristics of Entrepreneurial Learning Mindset Independent Variables | Statistics |
|----|---|---------------------------------------|
| C3 | Venture capitalism | $F = 4.05, df1=3, df2=158, p = .06.$ |
| C4 | Personality traits-curious, creative, effective, problem-solver, action oriented. | $F = 0.756, df1=3, df2=158, p = .45.$ |
| C5 | Positive attitude and self-confidence; dynamic outlook | $F = 0.650, df1=3, df2=158, p = .59.$ |
| C6 | Desires and motivation to accomplish, advance, etc. | $F = 0.548, df1=3, df2=158, p = .74.$ |
| C7 | Opportunity and preferences | $F = 5.920, df1=3, df2=158, p = .28.$ |
| C8 | Confidence and trust-ability or willingness to involve others, etc. | $F = 0.860, df1=3, df2=158, p = .47.$ |
| C9 | Measurement of Entrepreneurial Mindset Learning Context | $F = 1.290, df1=3, df2=158, p = .38.$ |

A value greater than .05 means that the variability in two conditions is about the same; the scores in one condition do not vary too much more than the scores in your second condition. In our results the variability in the characteristics in these categories is not significantly different

Appendix 2-Survey

“Understanding the Entrepreneurial-Mindset Characteristics”

This survey asks for your views on the differences in ideas and attitudes between a “regular college” and an "entrepreneurial-minded college student " This is a study designed to create suggestions for where the major variances may be found, to the research in social entrepreneurship and to create reliability to investigate any differences that may be found between a non-entrepreneurial and an entrepreneurial-minded student, with more reliability.

C1:1-4. What is your current rank position?

- Freshman or sophomore (1)
- Junior (2)
- Senior (3)

Other (please specify) (4)

C2:1-4. What is your major?

- Accounting / business (1)
- Engineering/Architecture/Construction (2)
- Information technology/Computer science (3)

Other (please specify) (4)

Listed below are statements or questions related to the characteristics, personality traits, personal attributes, motives, etc., often associated with entrepreneurs, entrepreneurship, entrepreneurial mindset, etc. This section seeks to understand how these helps shape our mindset as a learner. Please respond to the statements and or questions using the scales noted.

C3: 1-4. Venture Capitalist: I am seeing myself in the future:

1: Totally disagree, 2: Somewhat disagree, 3: Somewhat agree, 4: Totally agree.

1 2 3 4

- | | | | | | |
|----|--|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. | I am seeing myself owning my own business in the future | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. | I am seeing myself investing in a venture capital enterprise in the future | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. | I am seeing myself owning a franchise in the future | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. | I can only influence my own destiny if I own and manage my own business | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

C4:1-10. Personality Traits: To what degree do the following statements regarding personality traits correspond to your learning abilities?

1: Totally disagree, 2: Somewhat disagree, 3: Somewhat agree, 4: Totally agree.

1 2 3 4

- | | | | | | |
|-----|--|-----------------------|-----------------------|-----------------------|-----------------------|
| 1. | I like to give myself challenges when I take on a new project | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 2. | I am fairly at ease in difficult situations | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 3. | Where others see problems, I see possibilities | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 4. | I always worry about what others (influence) will think before doing something important | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 5. | I am curious, and I am continually in search of discovery | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 6. | I am a lot less effective in stressful situations | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 7. | I want to build or create something that will be recognized publicly | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 8. | When faced with difficulties, I look for alternative solutions | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 9. | For me, what counts is action | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 10. | For me, it is possible to influence one's destiny | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

C5:1-4 Personal Attributes: To what extent do these personal attributes conform to your learning abilities?

| | Not at all | Slightly | Considerably | Totally |
|-------------------------------------|---|---|---|--|
| Positive attitude | <input type="radio"/> Positive attitude Not at all | <input type="radio"/> Positive attitude Slightly | <input type="radio"/> Positive attitude Considerably | <input type="radio"/> Positive attitude Totally |
| Self-confidence in abilities | <input type="radio"/> Self-confidence in abilities Not at all | <input type="radio"/> Self-confidence in abilities Slightly | <input type="radio"/> Self-confidence in abilities Considerably | <input type="radio"/> Self-confidence in abilities Totally |
| Confidence in the future | <input type="radio"/> Confidence in the future Not at all | <input type="radio"/> Confidence in the future Slightly | <input type="radio"/> Confidence in the future Considerably | <input type="radio"/> Confidence in the future Totally |
| Dynamic outlook | Dynamic outlook Not at all | Have Dynamic outlook, slightly | Have Dynamic outlook, considerably | Have Dynamic outlook, totally |

C6:1-6. Motives: To what extent do these motives (desires and drives) shape your attitude towards learning?

| | Not at all | Slightly | Considerably | Totally |
|--------------------------------------|---|---|---|--|
| Desire to prove themselves | <input type="radio"/> Desire to prove themselves Not at all | <input type="radio"/> Desire to prove themselves Slightly | <input type="radio"/> Desire to prove themselves Considerably | <input type="radio"/> Desire to prove themselves Totally |
| Desire for advancement | <input type="radio"/> Desire for wealth Not at all | <input type="radio"/> Desire for wealth Slightly | <input type="radio"/> Desire for wealth Considerably | <input type="radio"/> Desire for wealth Totally |
| Drive to accomplish goals | <input type="radio"/> Drive to accomplish goals Not at all | <input type="radio"/> Drive to accomplish goals Slightly | <input type="radio"/> Drive to accomplish goals Considerably | <input type="radio"/> Drive to accomplish goals Totally |
| Drive to help others | <input type="radio"/> Drive to help others Not at all | <input type="radio"/> Drive to help others Slightly | <input type="radio"/> Drive to help others Considerably | <input type="radio"/> Drive to help others Totally |
| Drive for control | <input type="radio"/> Drive for control Not at all | <input type="radio"/> Drive for control Slightly | <input type="radio"/> Drive for control Considerably | <input type="radio"/> Drive for control Totally |
| Compelled to act upon an idea | <input type="radio"/> Compelled to act upon an idea Not at all | <input type="radio"/> Compelled to act upon an idea Slightly | <input type="radio"/> Compelled to act upon an idea Considerably | <input type="radio"/> Compelled to act upon an idea Totally |

C7:1-8. Opportunities and Preferences: Which of these opportunities and preferences statements do you think apply most to your capabilities to learn as a student?

Please check all boxes which apply. If they check use (1) no check (use 2)

- An ability to spot and catch opportunities
- An ability to involve others in activities
- More opportunities being available
- A preference for self-determination in class work
- A preference for working alone or with few others
- A preference for flexibility in methods of doing my class working
- A preference for pursuing several courses
- All the above

C8:1-5. Confidence & Trust: To what extent do confidence and trust aid in your level of learning abilities?

| | Not at all | Slightly | Considerably | Totally |
|--------------------------------------|--|--|--|---|
| Level of curiosity | <input type="radio"/> Level of curiosity Not at all | <input type="radio"/> Level of curiosity Slightly | <input type="radio"/> Level of curiosity Considerably | <input type="radio"/> Level of curiosity Totally |
| Self-confidence | <input type="radio"/> Self-confidence Not at all | <input type="radio"/> Self-confidence Slightly | <input type="radio"/> Self-confidence Considerably | <input type="radio"/> Self-confidence Totally |
| Trust in others in business | <input type="radio"/> Trust in others in business Not at all | <input type="radio"/> Trust in others in business Slightly | <input type="radio"/> Trust in others in business Considerably | <input type="radio"/> Trust in others in business Totally |
| Boredom threshold | <input type="radio"/> Boredom Threshold Not at all | <input type="radio"/> Boredom Threshold Slightly | <input type="radio"/> Boredom Threshold Considerably | <input type="radio"/> Boredom Threshold Totally |
| Willingness to involve others | <input type="radio"/> Willingness to involve others Not at all | <input type="radio"/> Willingness to involve others Slightly | <input type="radio"/> Willingness to involve others Considerably | <input type="radio"/> Willingness to involve others Totally |

C9:1-10. Learning Environment and Context: The following statements apply to the entrepreneurial minded learning environment and context!

1: Totally disagree, 2: Somewhat disagree, 3: Somewhat agree, 4: Totally agree. 1 2 3 4

- 1. Purposeful Learning—Commitment to achievement
- 2. Disciplined Learning—Focus is the learners' energy
- 3. Systematic Learning—Logical sequence
- 4. Entrepreneurial Learning is Innovative and focuses on resources
- 5. Learning must be coupled with strategy

6. Entrepreneurial learning involves learning by association
7. Entrepreneurial learning involves constant inquiry
8. Entrepreneurial learning involves an innovative approach to solutions
9. Entrepreneurial learning creates an attitude of lasting change
10. It is never too late to begin creating an entrepreneurial mindset

C10. Further Comments (please add any information you would like considered, which were not addressed above)