A Correlational Study of Belongingness and Persistence in Engineering Academies Students

Bjorn Harald Bangstein

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in Engineering Academies Students

Bjorn Harald Bangstein

Approved by:

Dissertation Chair: Dr. Sue Adragna, PhD

Committee member: Dr. Patricia Tobin, PhD

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Abstract

The growing number of U.S. engineering jobs signifies a need for more students to pursue engineering degrees. To increase access to engineering education, in 2015, Texas A&M University established Engineering Academies (EA) in cooperation with selected community colleges. The problem addressed in this study was a lack of knowledge about why Texas A&M EA students' first-year retention have since 2015 consistently been about 10% lower than the rate for on-campus students. Researchers have suggested that sociological noncognitive factors such as belongingness may affect students' decisions to persist or leave engineering. The purpose of this quantitative correlational study was to examine the statistical relationships for three separate constructs of belongingness: (a) the classroom, (b) the university as a community, and (c) the university as an institution in relation to EA student persistence. The study was framed by student integration and servant leadership theories to determine how belongingness influences the intention to persist. Data were collected from an internet-based survey of 155 first-year EA students. Three Pearson product-moment correlations revealed statistically significant correlations between students' three constructs of belongingness and persistence with different strengths of associations (weak, medium, and strong). The findings suggest that leaders of Texas A&M University Engineering Academies should implement preentry intervention programs and college transition assistance to increase first-year retention. Recommendations for future research include determining if persistence for continued enrollment correlates with actual retention as well as assessing if preentry programs and college transition strategies enhance associations between belongingness and persistence for first-year EA students.

Keywords: belongingness, persistence, retention, co-enrolled student, community college pathway program, engineering academies.

Dedication

This dissertation is dedicated to my family. First, to my mother and father, Synnove and Bjorn Bangstein, thank you for encouraging me to go to college. To my wife, Rebeca, thank you for your love, endless support, and for believing in me. Finally, to son Bjornar and stepson Felipe, for your support and encouragement, thank you.

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Chapter 1: Introduction

Retaining first-year engineering students is essential to improving the graduation rates required to meet the U.S. demand for more engineers. The Bureau of Labor Statistics (USBLS, 2021) reported that by 2030, engineering-related jobs occupations are projected to increase by 6%, which is about as fast as the average for all occupations. A critical retention benchmark is student persistence to the second year (Huerta-Manzanilla et al., 2021). However, since 2016, engineering student enrollment has declined, a trend that was accelerated by the pandemic in 2019 (American Society for Engineering Education, 2021). Specifically, the American Society for Engineering Education reported a 3.6% decline in 2019 from before the pandemic and a 4.1% decline in 2020, implying retention is as important as enrollment. Additionally, science and engineering degrees represent 31.2% of the higher education degrees conferred in Texas, below the national average of 33.1% (National Science Board, National Science Foundation, 2022). Consistent with this trend, the overall first-year retention rate for Texas A&M University in fall 2020 was 85.9%; however, the retention rate for Engineering Academies students in a transfer program was about 10% lower (Retention and Graduation, n.d.). This difference has concerned the leaders of Texas A&M University Engineering Academies (EA).

Students leave college for many reasons. Traditional research on engineering students' retention has focused on the lack of mathematics and science preparedness in high schools (Cohen & Kelly, 2020), which may motivate students to drop out (Tinto, 1993). Alternatively, introducing the element of belongingness as a noncognitive factor affecting retention could reveal how EA students integrate into the university social system. Studying students' perceptions of belongingness could provide information on remediation activities to promote EA students' continued enrollment (persistence).

Background of the Problem

Currently, there is an increasing need for engineering professionals in the U.S. labor force. It is projected that 140,000 additional engineering positions will be generated in the United States by 2026 (Torpey, 2018). In response, states such as Texas are seeking to help younger members of the workforce stay competitive in the global marketplace (60x30TX plan, n.d.). Accordingly, the Texas Higher Education Coordinating Board (THECB) has developed a higher education and skill training plan. The plan's goal is that a certificate or a degree must be obtained by 60% of Texas residents between the ages of 25 and 34 by 2030 (60x30TX plan, n.d.).

Nearly 50% of engineering students have taken community college courses when starting to pursue a bachelor's degree in engineering (National Science Board, National Science Foundation, 2020). However, although roughly 50% of engineering students graduate, transfer students from community institutions graduate at a lower rate (Zhang, 2021). In addition, one fourth of engineering students switch to a nonengineering degree within their first two years of college (National Science Board, 2018). Moreover, transfer students from a community college often face challenges stemming from unclear pathways and policies regarding course-credit acceptance, which leads to a lack of motivation to pursue a degree from a 4-year institution (Grote et al., 2021).

As a result, in 2015, Texas A&M University established the Engineering Academies (EA) co-enrolled partnership transition program among selected community colleges in Texas. The EA program offers a clear pathway for co-enrolled students when admitted into the program to pursue a bachelor's degree in engineering from Texas A&M University. The EA program allows students to attend a partnership community college, earning course credits for up to four semesters for all their designated courses, including engineering courses taught by Texas A&M

University faculty located at the partner community college. After taking these courses, students transition to the main campus at Texas A&M University at College Station's campus and continue in their engineering degree program. The EA program includes campus engagement initiatives, which inform students about main campus social and academic opportunities and the various engineering majors offered at Texas A&M University. Hence, the EA partnership program increases access and opportunities for co-enrolled community college students to pursue an engineering degree and support the THECB goal to produce more engineers in Texas.

Statement of the Problem

Engineering education retention and the decreasing graduation rate are national issues (Huerta-Manzanilla et al., 2021). Approximately half of the students who enroll in an engineering program do not graduate (Louten, 2022). This issue is significant for U.S. national safety, economic competitiveness, environmental sustainability, social justice, and socioeconomic equity (Huerta-Manzanilla et al., 2021). Since 2015, first-year retention rates for co-enrolled students in the Texas A&M University EA program have been consistently about 10% lower than the rates for on-campus students (Retention and Graduation, n.d.). Concerned about the cause of the discrepancy in retention rates, Texas A&M EA leadership sought mitigations to increase student retention. Therefore, the problem addressed in this study was a lack of knowledge about why Texas A&M EA students' first-year retention rates have been consistently about 10% lower than the rates for on-campus students.

Many factors influence student retention, for example, lack of mathematics and science preparedness in high schools or social integration into the university environment (Cohen & Kelly, 2020). Social integration can foster belongingness in the university environment, enhance students' motivation and persistence, and be critical for students' academic success and mental

health. However, one area of social integration not well studied for co-enrolled partnership transition programs is students' belongingness (Louten, 2022).

Building a favorable environment conducive to a culture of belongingness in programs could inform a greater understanding of and support for persistence among first-year engineering students and help increase first-year retention rates (Louten, 2022). In addition, Gopalan and Brady (2020) recommended studying how belongingness corresponds with persistence for first-year retention among students. Researchers have suggested that social integration factors, such as belongingness to the classroom, university as a community, and university as an institution, can foster persistence (Baumeister & Robson, 2021; Smith et al., 2012; Tinto, 2022). It was possible that the lower retention rate for first-year EA students was linked to how the factors of belongingness relate to persistence.

Purpose of the Study

The purpose of this quantitative correlational study was to examine the statistical relationships for three separate constructs of belongingness: (a) the classroom, (b) the university as a community, and (c) the university as an institution in relation to EA students' persistence. A quantitative correlational study is a nonexperimental design that examines the strength of the relationships between independent and dependent variables (Gravetter et al., 2020). A nonexperimental design does not manipulate the independent variables and cannot imply causal relationships (Creswell & Guetterman, 2019).

This study had four variables: three independent and one dependent. The independent variables measured belongingness in (a) the classroom, (b) the university as a community, and (c) the university as an institution, using a subset of Anderson-Butcher and Conroy's (2002) measure for belonging and Lounsbury and DeNeui's (1996) measure for a sense of community.

The dependent variable measured persistence using the College Persistence Questionnaire (Davidson et al., 2009).

The study was necessary to enhance understanding of the factors of belongingness correlated with EA students' persistence. Moreover, a quantitative methodology aligned with a detailed, structured, deductive research approach consistent with the theoretical framework chosen for this study (Coccia, 2018; Trochim & Donnelly, 2006). Findings from this study could address Texas A&M University leadership concern about the discrepancy in EA student retention rate, which have been consistently about 10% lower compared to the retention rate for engineering students on the Texas A&M University campus. The target population for the study was 322 first-year students at Texas A&M Engineering Academies located in San Antonio, Austin, Dallas, Midland, and Blinn. The needed sample size was 112 respondents. Data gathering continued for 3 weeks in the fall semester of 2022. The analysis proceeded with the number of respondents who agreed to participate. The result of the quantitative correlational study may provide Texas A&M University EA leaders with the knowledge to create and implement practices for fostering belongingness correlating with persistence to improve first-year retention rates for EA students.

Significance of the Study

First, the significance of the study rests in its capacity to provide helpful information for Texas A&M leaders to increase first-year EA engineering student persistence, thereby improving EA engineering student retention and thus ensuring more engineering students graduate to meet the increased demand for engineering professionals (60x30TX plan, n.d.; Huerta-Manzanilla et al., 2021; Torpey, 2018). Second, the result from this research on the determination of association between belongingness and persistence in (a) the classroom, (b) the university as a

community, and (c) the university as an institution among Texas A&M first-year EA engineering students may contribute to the knowledge base on retention as well as inform other institutions' leaders on transfer college pathway programs. Third, the study could be significant for providing data on the correlation between the factors of belongingness and persistence that could help improve Texas A&M EA programs and practices to increase first-year retention.

Research Questions

The following research questions guided this study:

Research Question 1: To what extent is there a statistically significant relationship between belongingness to the classroom and persistence among Engineering Academies students?

Research Question 2: To what extent is there a statistically significant relationship between belongingness to the university as a community and persistence among Engineering Academies students?

Research Question 3: To what extent is there a statistically significant relationship between belongingness to the university as an institution (4-year institution) and persistence among Engineering Academies students?

Hypotheses

The following research hypotheses determined the level of significant correlation relationships between belongingness and persistence:

$H1_0$: There is no significant correlation between belongingness to the classroom and persistence among Engineering Academies students.

$H1_a$: There is a significant correlation between belongingness to the classroom and persistence among Engineering Academies students.

$H2_0$: There is no significant correlation between belongingness to the university as a community and persistence among Engineering Academies students.

$H2_a$: There is a significant correlation between belongingness to the university as a community and persistence among Engineering Academies students.

$H3_0$: There is no significant correlation between belonging to the university as an institution (4-year institution) and persistence among Engineering Academies students.

$H3_a$: There is a significant correlation between belonging to the university as an institution (4-year institution) and persistence among Engineering Academies students.

Theoretical Framework

Tinto's (1993) student integration theory and Greenleaf's (2002) servant leadership theory were used to understand factors that correlated with persistence. Tinto's student integration theory focuses on measuring students' academic and social integration and determining student persistence. The theory of student integration emerged from prior research in sociology from Durkheim's (1951) theory of suicide and van Gennep's (1960) theory of rites of passage.

Durkheim's theory of suicide was relevant for understanding the mindset that leads to a student's disengagement and subsequent loss of belongingness (Jia et al., 2022). According to van Gennep's (1960) theory of rites of passage, three significant stages affect transformation: (a) separation, (b) transition, and (c) incorporation. Tinto (1993) proposed that first-year students go through comparable rites of passage as they leave their high school environment, transition, and integrate into a college community.

Students need to have regular, positive encounters with peers to maintain relationships (Baumeister & Robson, 2021). Developing social relationships is a natural process for people,

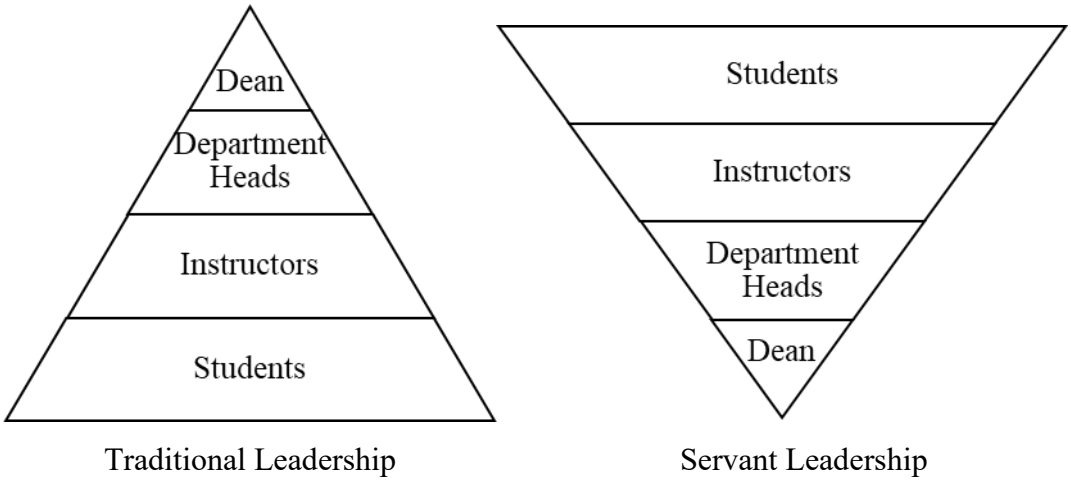
consistent with the concept of belongingness (Baumeister & Robson, 2021). The feeling of belongingness influences emotional patterns, motivation, and cognitive processes (Pedler et al., 2022). In fact, belongingness is so fundamental to human behavior that it could serve as the first premise for virtually any social or cultural behavior theory, many of which state that people are driven by a strong desire to establish and maintain a minimal number of long-lasting, healthy, and substantial interpersonal interactions (Baumeister & Leary, 1995).

Tinto's (1993) student integration theory has emerged as the most significant, most widely used theory on persistence and retention in higher education (Fraysier et al., 2020). Social and intellectual integration is necessary for students to feel welcomed into an institution and integrated with the campus culture, classmates, and instructors in the classroom setting. Therefore, students' institutional integration into the academic and social systems was the most important aspect in this model (Tinto, 1993).

Greenleaf's theory of servant leadership is typically implemented to help institutional leaders alter administration and instructional processes to meet students' needs by connecting with and understanding their barriers and needs (Crippen & Willows, 2019; Khatri et al., 2021). Servant leadership has helped students reach their potential academically and socially (Gultekin & Dougherty, 2021). Figure 1 shows a visual comparison of traditional and servant leadership.

Figure 1

Traditional vs. Servant Leadership



Note. The figure compares the usual top-to-bottom leadership strategy to the inverse of its assumptions. Servant leaders, deans, department heads, and faculty put the needs of students first rather than their own requirements or the university's goals (Khatri et al., 2021).

Definitions of Terms

Belongingness is the feeling of acceptance and experience of mattering as membership in a group or community (Baumeister & Leary, 1995), associated with success in college (Tice et al., 2021). Moreover, Baumeister and Leary (1995) noted that belongingness is fundamental for human behavior and motivation.

Co-enrollment is defined as the enrollment of students in two institutions simultaneously (Taggart, 2022).

Persistence refers to students' persistent effort or ability to stay enrolled after the first year and integrate into the institution's academic and social life (Davidson et al., 2009).

Retention is the ability of an educational institution to avoid student dropout and keep students enrolled until graduation. Retention rate is measured as the percentage of students who

stay at the same institution (Pedler et al., 2022).

Transition students are co-enrolled and will transition from one higher education institution to the other to achieve a more advanced degree (Grote et al., 2021).

Transfer pathway programs allow community college students to co-enroll and transition to a 4-year institution and validate earned course credits (Schudde et al., 2021a).

Assumptions

Assumptions are elements of a study that are assumed to be true (Creswell & Guetterman, 2019). Rather than being deductive in nature, assumptions depend on researchers' prior experiences in gathering and analyzing information (Creswell & Guetterman, 2019). First, although various research methods were considered for this study, it was anticipated that a quantitative correlational research approach was most appropriate because it would provide information to improve retention and graduation rates of engineering students. Quantitative research allows researchers to examine the relationship-based research questions regarding whether relationships exist between the pairs of variables (Gravetter et al., 2020).

Second, assumption was that the online survey instruments are statistically valid in determining the correlational strength and direction between belongingness and persistence of the participants in the study (Anderson-Buthcher and Conroy; 2002; Davidson et al., 2009; Lounsburt and DeNeui; 1996). Third, assumption was that participants would be willing to join the study. Fourth, assumption was anticipated that the participants would be genuine and honest in answering the questions. The final assumption was that persistence was correlated to belongingness and not affected by other factors not considered in this study.

Scope and Delimitations

Scope and delimitations are within the researcher's control, which describe boundaries or

restrictions set for the study so that aims and objectives may be achieved (Theofanidis & Fountouki, 2019). Most previous research focused on community college students transferring to 4-year institutions (Grote et al., 2021). In contrast, the focus of the study was on co-enrolled Texas A&M University Engineering Academies (EA) students taking courses at a partner community college during their first year. The study used a quantitative correlational research design to examine the relationships between three belongingness variables and the persistence variable. The study comprised co-enrolled EA students in San Antonio, Austin, Dallas, Midland, and Blinn, representing the first delimitation.

The second delimitation was focusing the study on the three belongingness variables and excluding all the other factors that affect persistence. Hence the study excluded student academic achievement, family financial situation, personal qualities, and high school academic background. The third delimitation was the use of an online survey. Although the study sample size aimed for 112 participants, email invitations to participate could have been ignored, thus limiting the number of participants (Creswell & Guetterman, 2019). Survey data gathering was active for 3 weeks, and analysis was conducted based on the number of responses received at the end of the survey period.

The fourth delimitation of the study was the focus of the correlational design on the strength and direction of the relationships between dependent and independent variables. On the one hand, the investigation's breadth eliminated the likelihood that the data might be irrelevant in future co-enrolled programs. However, the study encompassed only co-enrolled Texas A&M University EA students, thus limiting generalization to other community college transfer programs.

Limitations

Limitations are those components of a study beyond the researcher's control, including impacts stemming from the research design and methodology (Theofanidis & Fountouki, 2019). The first limitation was that, by definition, the quantitative design examined the correlational strength between the variables rather than seeking to indicate causation (Creswell & Guetterman, 2019). A second limitation was that the research was conducted in a single university department. The total population of 322 first-year EA students from Texas A&M Engineering Academies in San Antonio, Austin, Dallas, Midland, and Blinn was invited to participate in the study. This sample size limited the generalization of findings to other on-campus departments and students.

Finally, a third limitation was the research process itself. The study relied on self-reported data collected through web-based surveys, which could have yielded lower response rates compared to traditional methods. For example, Daikeler et al. (2020) found a difference of 12% in response rates between mail and telephone surveys. Further, web-based email survey invitations could have been ignored or routed to spam filters, thus making them unavailable (Daikeler et al., 2020).

Chapter Summary

An ongoing need to increase the number of engineering professionals in the U.S. workforce was identified. The Bureau of Labor Statistics (USBLS, 2021) reported that by 2030, engineering-related occupations are projected to increase by 6%, in line with the average increase for all occupations. In response to the increasing need for engineers, Texas A&M University established a co-enrollment program in 2015 with selected community colleges in Texas to ease access to 4-year engineering education. A critical retention benchmark for

graduation is first-year student persistence to the second year (Huerta-Manzanilla et al., 2021). The problem identified in this study was a lack of knowledge about why that Texas A&M EA students' first-year retention rate have been consistently about 10% lower than the rate for on-campus students (Retention and Graduation, n.d.). Belongingness is a significant sociological noncognitive and affective factor determining students' decisions to persist or drop out of college (Scheidt et al., 2021; Tinto, 1975, 1993).

The purpose of this quantitative correlational study was to examine the statistical relationships between the three separate constructs of belongingness: (a) the classroom, (b) the university as a community, and (c) university as an institution and EA students' persistence. A quantitative correlational study is a nonexperimental design that examines the strength of the relationships between independent and dependent variables (Gravetter et al., 2020). A study of these statistical relationships could contribute to the current literature and advance the body of knowledge on how belongingness correlates to persistence for first-year retention among EA students at 4-year institutions (Gopalan & Brady, 2020; Zhang, 2021).

In addition, identifying the correlation strength and direction between the three factors of belongingness and persistence could help leaders at Texas A&M University EA better understand the reasons behind EA students retention rates and find mitigations to increase the first year retention. The following chapter includes a comprehensive literature review exploring the theoretical framework for the study and related research. The literature review centers on belongingness and persistence for students in 2-year and 4-year institutions, based on Tinto's (1993) student integration theory and Greenleaf's (2002) theory of servant leadership.

Chapter 2: Literature Review

According to Chen (2013) the graduation rate for U.S. engineering students over the past several decades has remained around 50% and less for students transferring from a community college (Callahan et al., 2022; Zhang, 2021). Without an increase in graduates in the engineering workforce, the U.S. could lose engineering supremacy, thus threatening its capability to solve local and global problems (Zhang, 2021). The importance of improving graduation rates has produced a steady flow of scholarly work on retaining engineering students.

Texas A&M University (Texas A&M) established in 2015 the Engineering Academies (EA) in cooperation with six community colleges in Texas to increase the availability of engineering degrees. The problem addressed in this study was a lack of knowledge about why Texas A&M EA students' first-year retention rates have been consistently about 10% lower than the rates for on-campus students (Retention and Graduation, n.d.). Belongingness has emerged as a significant sociological noncognitive factor affecting engineering students' retention and graduation choices (Bean, 1982; Geisinger & Raman, 2013; Kendall et al., 2019; Scheidt et al., 2021; Tinto, 1975, 1993). Further, belongingness has been associated with persistence and retention toward graduation for students at a 4-year institution (Gopalan & Brady, 2020; Verdín, 2021).

Therefore, the purpose of this quantitative correlational study was to examine the statistical relationships for three separate constructs of belongingness: (a) the classroom, (b) the university as a community, and (c) the university as an institution in relation to EA students' persistence. Examining these statistical relationships was intended to address the knowledge gap identified in the following literature review. This chapter provides the literature search strategy, a

discussion of the theoretical framework, and a review of relevant literature. The chapter closes with a summary.

Literature Search Strategy

The literature search began with the identification of empirical terms relevant to the research topic. The search for peer-reviewed articles was conducted through the American College of Education online library and open-access applications. Several databases were used for discovery: (a) Academic Search Complete, (b) EBSCO, (c) ERIC, (d) JSTOR, (e) Google Scholar, (f) ProQuest, and (g) SAGE Journals. The following keywords and descriptors were used alone and in combination to access information pertinent to the study: *academic achievement, academic engagement, academic performance, academic persistence, acceptance, affective factors, assimilate, association, attachment, attrition, be an adherent of, belonging, belongingness, blend in, cohort program, college life, college persistence, community college student, commuter colleges transfer, commuter student, congruence, connectedness, engagement, extracurricular activities, identification, inclusion, mattering, noncognitive factors, nontraditional students, persistence, program effectiveness, rapport, relationship, self-efficacy, sense of community, sense of self-efficacy, servant leadership theory, student attrition, student college relationship, student integration theory, students transition students, first-year students, teacher-student relationship, uptake,* and *withdrawal*. Boolean operators *NOT* and *OR* were used to locate relevant articles. References within the articles were used to identify other literature related to the dissertation topic. All articles were placed in the American College of Education thematic grid for summarizing and synthesizing. RefWorks assisted with citing sources and organizing the reference list.

Theoretical Framework

Greenleaf's (2002) servant leadership theory and Tinto's (1993) student integration theory were used to understand how belongingness influences student persistence. The student integration theory focuses on students' academic and social integration as determinants of student persistence. Servant leadership theory refers to leaders helping students reach their academic and social potential (Gultekin & Dougherty, 2021). Together, these theories clarify how institutional leaders, administrators, and faculty support students' transition and belongingness in a new environment. In addition, the theoretical framework helps reveal practices that support the formation of students' persistence and retention toward graduation.

Theory of Servant Leadership

Servant leadership is a leadership construct in which the leader leads by fulfilling the needs of followers (Greenleaf, 2002). Servant leaders nurture growth and foster individual accomplishments of their followers by serving followers' physical and emotional well-being. Hence, servant leaders seek first to understand and relate to followers' needs and then to nurture them (Northouse, 2021). Singh and Ryhal (2021) noted that servant leaders are good listeners who strive to comprehend their followers' challenges and worries while reaffirming their confidence. Servant leadership has been linked to positive individual outcomes, such as mental health, belongingness, and performance (Northouse, 2021). As a leadership style, servant leadership prioritizes serving others first and then leading as a means of improving organizational performance (Greenleaf, 2002). Stein (2020) reported that servant leaders emphasize maximizing their followers' potential and aiding their personal development.

In education, servant leadership emphasizes ways of serving students that lead to improved academic outcomes (Stein, 2020). Institutional leaders, administrators, and faculty

seeking to be servant leaders establish relationships with students to guide and serve them by demonstrating a sincere desire to help them succeed (Stein, 2020). In addition, servant leadership has been demonstrated to relate to community building and fostering belongingness to an organization, reinforcing people's confidence in their work or studies (Meuser & Smallfield, 2022). For example, Turner (2022) found that servant leadership in higher education institutions fosters positive relationships supporting individual well-being and promotes a community of belongingness, enabling followers to accomplish shared and individual goals and visions. Therefore, servant leadership has emerged as a practice salient for an institution's leadership and teaching practices to serve students' needs in establishing belongingness and fostering persistence (Crippen & Willows, 2019). Hence, servant leadership theory was central to the theoretical framework in this study through evaluating perspectives on student belongingness and persistence.

Theory of Student Integration

Before 1970, student retention research centered mainly on cognitive factors or characteristics of students' ability to persist and progress in college, often focusing on grade-point average (GPA) scores and parents' education levels (Tinto, 2006). Since 1970, researchers have developed descriptive retention theories based on student—institution sociological relationships (Astin, 1984; Spady, 1971; Tinto, 1975). Tinto's theory of student integration, also known as the institutional departure theory, has emerged as an influential theory for persistence and retention in higher education (Fraysier et al., 2020). The salient factor in this theory consists of students' institutional experiences of integration into the school's academic and social systems (Tinto, 1975).

The theory of student integration is based on prior research in sociology from

Durkheim's (1951) theory of suicide and van Gennep's (1960) theory of rites of passage. Durkheim's theory of suicide is relevant for understanding the mindset that leads to a student's withdrawal and associated lack of belongingness. Van Gennep's theory of rites of passage defines three significant stages of transformation: (a) separation, (b) transition, and (c) incorporation. Tinto (1993) suggested that first-year students engage in similar rites of passage when separating from the high school environment and transitioning and integrating into a college community.

In developing the theory of student integration, Tinto (1993) recognized that social and academic integration is a longitudinal process that over time can lead to the formation of persistence or the decision to drop out. Tinto's theory was later improved to include more diverse populations and institution types. To develop the improved theory, Tinto studied nontraditional community college students with different family backgrounds who selected different pathways into college. Students' different pathway choices highlighted the need for educators to create experiences that support students' integration into academic and social systems for retention (Tinto, 1993). Tinto's theory states that social and academic integration is relevant for students to feel accepted into the institution and integrated with campus culture, peers, and instructors in the classroom environment.

Previous research has validated the theory of student integration in higher education to recognize that institutional experiences influence students' integration, which reinforces students' commitment and outcome decisions (Aljohani, 2016). Dedication to an institution leads to increased persistence and empowers students to reach their goal of completing a college degree (Tinto, 1993). Tinto noted that if academic and social integration occurs, students are more likely to persist even when not evenly academically and socially integrated. That is,

students who have developed belongingness through social integration—even those with weaker academic integration—are more likely to persist to graduation and have successful transitions within the institution and campus communities (Astin, 1984; Spady, 1971; Tinto, 1975).

Research Literature Review

The research literature review section provides insight into the current literature on college belongingness and persistence, focusing on first-year engineering students in community college pathway programs. The section is divided into six subsections. The first section defines student belongingness, followed by section two on belongingness in the classroom, then section three the belongingness to the campus community, and section four on belongingness to the 4-year institution. Section five contains literature on persistence at community colleges, and finally, section six is about institutional partnerships for transition college programs.

Belongingness

Students' belongingness is considered one of the significant noncognitive factors influencing and fostering persistence for first-year students (Gopalan & Brady, 2020). Tinto's (1993) seminal work on student integration theory showed that unpleasant experiences could hinder academic and social integration, resulting in weak belongingness and possibly a decision to drop out of college. Moreover, improving students' sense of belongingness by serving students' needs at the institutional and classroom level aligns with servant leadership and student integration theories.

Researchers have claimed that institutional leaders and faculty must recognize and be responsive to students' different needs and learning preferences to foster social integration. For example, a quantitative study of first-year students located at three large Midwestern state university systems in two cohorts (n = 337, n = 298) found a statistically significant relationship

between belongingness and interest (Cole et al., 2020). Additionally, Cole et al. found a statistically significant relationships between the quality of care provided by staff and faculty, the level of social interaction among peers, with belongingness.

In another study, Hopkins et al., (2021) applied a qualitative approach to explore how out-of-classroom experiences influenced the persistence of first-generation first-year students with diverse racial backgrounds at a university in Georgia. Hopkins et al. discovered that out-of-classroom experiences with faculty focusing on students' needs and development enhanced students' belongingness to a community and persistence. Similarly, a recent national survey (N = 23,750) of first-year college students found that belongingness varied between 2- and 4-year institutions with minorities and first-generation students (Gopalan & Brady, 2020). For example, at a 4-year institution, students reported a high belongingness, but lower rates for minorities and the first generation (Gopalan & Brady, 2020). The opposite occurred at a 2-year college but less significantly.

Additionally, Gopalan and Brady (2020) noted that belongingness was significantly associated with persistence at both 2- and 4-year colleges. The variability in the belongingness among minorities and first-generation students at 2- and 4-year institutions was lower at the 2-year institution. The variability warrants future studies on the belongingness and persistence of students at a 2-year college (Gopalan & Brady, 2020), as well as on how belongingness develops and correlates to persistence for 2- and 4-year institutions. Additionally, the literature has recommended further study on belongingness for first-year students at community colleges (Gopalan & Brady, 2020; National Academies of Sciences, Engineering, and Medicine, 2021; Scheidt et al., 2021). To date, the correlation between belongingness and persistence for students in the Texas A&M EA transition program has not been researched. The recognition of humans'

need for belongingness has been firmly established in social psychology. For example, Schachter (1959) noticed the significance of affiliation in human interaction for survival and motivation. Maslow (1954) ranked love and belongingness as a prerequisite for achievement, esteem, and self-actualization. Psychologists have emphasized belongingness as essential for persistence toward a positive outcome (Baumeister & Leary, 1995).

Belongingness is conceptualized as a human need. Its absence can lead to frustration and adversely affect motivation (Baumeister & Robson, 2021). Baumeister and Leary (1995) noted that belongingness is dependent on affective interests between peers who have frequent interactions over time. Hence, students must have shared interests and goals that create frequent interactions and participation in classroom and campus community activities to foster belongingness. The National Academies of Sciences, Engineering, and Medicine (2021) reported that belongingness was lowest in first-generation college students when they experienced different and unfamiliar situations or felt as if they were unsupported, marginalized, or unwelcome.

In a study with 42 participating countries, low socioeconomic and foreign-born students were most likely to feel a lack of belongingness in their respective schools (Willms, 2003). Further, Gillen-O'Neel (2021) argued that a person's belongingness relates to context. Therefore, it seems essential to understand the distinctions among students' belongingness in the context of their engineering classroom, community, and university (Rainey et al., 2021).

Belongingness and Identity

Regarding the interactions among belongingness, engineering identity, and maker space experiences, students have reported various perspectives on their engineering identity and belongingness, especially regarding how maker space experiences might affect these attitudes

(Andrews et al., 2021). A maker space is a facility at the campus that enables students to work in teams to design and make things from various materials using cutting-edge technologies such as computerized design tools, three-dimensional (3D) printing, and traditional hand tools (Alemán et al., 2022). For students, a maker space is more than a room full of tools; it is a place for establishing a community among peers that allow for individual expression and personal development (Tomko et al., 2021). Moreover, Andrews et al. (2021) noted that first-year engineering students participating in maker space activities showed improved academic performance and expressed belongingness. Students interpreted engineering identity as a means of comparing themselves to their peers, whereas they interpreted belongingness as a trusting attachment toward each other (Andrews et al., 2021). These findings have significance for engineering educators and design instructors interested in fostering ways of being and belongingness among engineering students (Andrews et al., 2021; Bouwma-Gearhart et al., 2021).

Students have defined positive feelings of belongingness as either specific skill sets or attitudes and beliefs that they possessed or lacked. In one study, although students' opinions of how much they belonged in engineering differed, they all described belongingness as either an essential assessment of their skills or related to their attitudes and beliefs (Verdín et al., 2018). A binary categorization was clear when students discussed their characteristics of belongingness. For example, they described innovation as vital to belongingness only if they considered themselves to be innovators. These students assessed themselves using a pass–fail criterion based on a fictitious representation of engineering characteristics. Thus, it seems characteristics have ramifications for engineering educators' interventions aimed at increasing belongingness. However, the assertive responses of the students raise the question of which characteristics must

be present to attain belongingness in engineering (Rohde et al., 2020).

Factors that Influence Belongingness

College transfer students want to feel they belong—hence, they pursue belongingness by associating themselves with the institution and establishing meaningful interactions with faculty and peers. Shaw et al. (2019) studied first-year transfer students' belongingness, including their experiences engaging in relationships with peers, faculty, and institutional leaders. Shaw et al. found that community college students tend to develop self-doubt about their ability to succeed, which results in imposter feelings and experience stigma because of their status as former community college students, resulting in less belongingness (Stein, 2020).

Peers, faculty, and academic advisors, as essential on-campus sources of information and support, are salient factors in the belongingness construct for students transitioning to college. Commuter students at community colleges often have responsibilities outside campus, including working part-time; therefore, they have many off-campus sources of information and relationships (Rucks-Ahidiana & Bork, 2020). Further, Rucks-Ahidiana and Bork found from interviews with first-year community college students that 60% experienced close relationships with family and friends. In contrast, fewer than 50% experienced close on-campus relationships. Additionally, first-year students reported having close relations with peers but only transactional relationships with faculty and staff. Off-campus relationships for community college students are important for students' motivation and inspiration (Reyes et al., 2019).

In contrast, having on-campus relationships with peers affects their belongingness development. Students who experience belongingness on campus more often have influential relationships with peers and faculty and experience frequent social support as an outcome (Abdollahi et al., 2020; Rucks-Ahidiana & Bork, 2020). In one study, elevated stress levels

experienced by college students predicted increased feelings of loneliness resulting in a lack of belongingness, which appeared to have a substantial effect on psychological adjustment issues (Satici, 2020). In addition, loneliness can cause students to feel less alert, de-energized, isolated, and lacking in belongingness (Satici, 2020). These findings suggest that belongingness is a significant factor that could aid in developing prevention and intervention methods to promote students' psychological health and well-being in university settings (Arslan, 2021). Moreover, Arslan noted that a lack of belongingness is a predictor of mental health problems and significantly predict school-based social inclusion and exclusion.

Social skills have a crucial effect on students' feelings of loneliness, despair, anxiety, and ability to foster belongingness (Moeller et al., 2020). Further, lack of peer acceptance is a vital factor influencing belongingness and depression. Belongingness may protect against the detrimental consequences of low peer acceptance and loneliness (Baumeister & Robson, 2021).

Depression is one of the most common mental diseases found among college students (Lauckner et al., 2020). Moreover, depression is associated with lower academic performance, significant role impairment (Mei et al., 2020), and increased risk of college dropout (Thomas et al., 2021). Further, Kivlighan et al. (2021) found that students who saw therapists at a university counseling center were associated with an increased grade-point average (GPA) and reductions in psychological distress.

Perceived social problem-solving deficits have been associated with suicide risk (Rodríguez-Otero et al., 2021). Suicide risk is higher in college-aged students and people who have experienced interpersonal trauma and lack of belongingness (Poindexter et al., 2022). Chu et al. (2018) tested the indirect effects of cumulative interpersonal trauma occurring because of depression, lack of belongingness, and perceived burdensomeness, using the interpersonal theory

of suicide as a framework to test the relationship between cumulative interpersonal trauma and suicide ideation. As evidenced by symptoms of depression, Chu et al. found interpersonal suicide ideation was present in trauma stemming from depression. Greater numbers of depressive symptoms were found to explain the link between cumulative interpersonal trauma and suicide ideation (Poindexter et al., 2022).

Despite the evidence for the importance of establishing belongingness in engineering college, minority students have described feeling they must prove they belong and matter because they believe educators assume minority students are less important, compared to their student peers (Lee et al., 2020). Such experiences decrease belongingness; therefore, minority students must develop resilience from self-beliefs to progress academically toward graduation. Wu et al. (2020) found that the essential effect of self-efficacy and task value in engineering college students' achievement stemmed from behaviors aimed toward persistence formation and academic continuation. The term *academic resilience* refers to a student's achievement despite challenging or negative experiences (Wu et al., 2022). Resilience can increase the probability of social integration, fostering belongingness and academic progress even in the presence of conditions brought on by trait labeling, adverse environments, and setbacks (Haktanir et al., 2021).

Belongingness in the Classroom

Teachers and scholars have advocated that increasing and maintaining students' belongingness at school is one way to stimulate students' intention or desire to learn and reduce dropout decisions (Allen et al., 2022). Students develop belongingness through reciprocal caring interactions with teachers, peer friendships, and cooperative classroom activities (Saroyan, 2021). Students' belongingness increases from previous positive academic experiences from

high school (Dumford et al., 2019). With academic preparation and close social connections with family or friends, students quickly transition to college by establishing a strong belongingness to the classroom (Moore, 2020). Strong belongingness to the classroom has been associated with persistence if interaction with faculty and peers is encouraging, especially for students with diverse learning styles (Moore, 2020). Adjusting the classroom environment to support all learners creates a team feeling that helps students establish belongingness to the classroom and thereby persist (Cooper & Fry, 2020). Active learning strategies such as flipped classrooms and project-based learning, discussed in the following sections, can encourage the establishment of peer-group relationships that foster belongingness in the classroom (Moore, 2020). In addition, Moore noted that these active learning strategies position the faculty as classroom community facilitators, making them more accessible, relatable, and inclusive.

Flipped Classroom and Active Learning

A flipped classroom is an integrated learning strategy in which students receive course material at home and then practice working through it at school (Hew & Lo, 2018). Students in a flipped classroom watch online lectures, participate in online conversations, or do research at home while learning in the classroom with the help of a teacher (Hew & Lo, 2018). Flipped classrooms were implemented in early 2000, called *inverted classrooms*, in which students focused on assignments or group tasks in plenum based on preexposure to the lecture topic, resulting in significant learning improvements compared to traditional instruction (Jaiswal et al., 2021).

Many schools and institutions have adopted the flipped-classroom concept because it fosters increased peer interaction, teamwork, and classroom belongingness (Turan & Akdag-Cimen, 2020). In addition, students have greater engagement with the curriculum (Hwang &

Chen, 2019). Because of its ability to combine learning theories formerly considered incompatible, the flipped-classroom concept seems especially helpful in teaching science, mathematics, and engineering topics (Wright & Park, 2021).

Flexibility in the teaching practice, improved interaction, enhanced professional skills, and increased student engagement are reported benefits of flipped-classroom learning (Kay et al., 2019). Flipped-classroom learning, alongside other student-centered instructional techniques, lets students learn the material and build professional skills needed in today's competitive global market and changing work environment (Kay et al., 2019). However, self-directed teamwork is a challenge for U.S. students, who may have a strong focus on individual performance (Lawter & Garnjost, 2021). Flipped-classroom learning is where students and teacher roles are flipped, which supports an active learning process through establishing belongingness, and aligns with a professional approach to teamwork and cooperation. Hence, success is highly dependent on qualified teachers who communicate clearly, apply appropriate curriculum and assessments, and employ teaching practices and strategies for fostering classroom belongingness.

Project-Based Learning

A project is a time-bound and focused procedure that enables the formulation, analysis, and resolution of problems to produce tangible results (Rohm et al., 2021). The initial point guiding the student's learning process is analyzing the problem as a team activity, followed by planning and working together to manage the completion of a project over a given time. Hence, project-based learning (PBL) is a teaching strategy that supports student development of teamwork skills and fosters belongingness to the project team, instructor, and classroom (Oh et al., 2020). In addition, students develop valuable knowledge and skills throughout their allotted project periods when solving real-world problems in professional settings (Aksela & Haatainen,

2019). PBL encourages students to cooperate closely with each other to build belongingness through teamwork, develop critical thinking, and gain self-management skills. Oh et al. reported that PBL encourages students to conduct research, make team decisions, and openly discuss ideas offered by their peers. In addition, when students receive the opportunity to display their project work publicly as a team, they improve their public speaking skills as they present their completed projects and explain project outcomes. Thus, PBL allows students to gain skills and experiences transferable to contexts beyond the problem itself (Aksela & Haatainen, 2019; Rohm et al., 2021).

Moreover, PBL is critical to boosting student achievement and persistence for long-term progress (Aksela & Haatainen, 2019). Collaboration, introspection, and individual decision-making provide students with scenarios appropriate to real-world issues as they progress in their education and confront as they enter the workforce (Rohm et al., 2021). Further, PBL's professional work environment authenticity allows students to express personal interests, problems, or important issues. Instead of completing a predetermined assignment, with PBL, students can observe issues or concerns, choose ones that interest them, and discuss solutions to the problem in a classroom environment. Several university-level classrooms have transitioned from instructor-led to student-centered active learning PBL strategies resulting in an increased studenst motivation and persistence (Aksela & Haatainen, 2019; Ryan & Deci, 2020). Hence, students find PBL more engaging, with increased autonomy in their learning process that fosters team establishment and classroom belongingness (Almulla, 2020; Oh et al., 2020).

Peer-Group Relationships

Researchers have noted that the transition into higher education institutions comes with less direct support from professors, peers, and institutions, leading to student loneliness and

decreased academic performance and persistence (Ahn & Davis, 2020; Strayhorn, 2018). On the other hand, peer-group relationships can positively affect first-year students' transition into college by establishing belongingness. Davis et al. (2019) claimed that the social interaction in peer groups correlated directly with belongingness to the institution and classroom more substantially than even faculty interaction. In addition, social relationships gained through membership in campus leadership groups can increase students' belongingness to a classroom environment (Ahn & Davis, 2020).

Acceptance into a peer group can create strong connections between group members. In fact, even if their group engages in undesirable behaviors, people seek out peer groups who embrace them (Cowie et al., 2018). Students in a peer group have a lot in common regarding conduct and attitudes (Cowie et al., 2018). However, schools can influence with whom students interact and how they connect. Peer relationships are crucial, and they may be both helpful and challenging (Cowie et al., 2018). For example, peer rejection could result in subsequent behavioral issues. Among engineering students, acceptance from other students is essential for self-esteem, inclusion, and identity development (Jensen & Cross, 2021).

Peer rejection may signal future behavioral issues (especially when people are rejected because of aggressive behavior). Bullying, peer victimization, and managing conformity expectations become more difficult as students get older (Cowie et al., 2018). Students make social comparisons with classmates to assess their abilities, knowledge, and personal traits, but such comparisons may also make them feel as if they do not measure up (Kindermann & Gest, 2018).

In addition, problems in peer interactions, such as bullying, may have significant psychological, physical, intellectual, and social-emotional effects on both victims and offenders

(Kindermann & Gest, 2018). Kindermann and Gest argued that having peers is crucial because peers can protect and shield group members. Thus, strong peer relationships may improve students' mental health. In addition, peer relationships provide social support, understanding, and acceptance in developing belongingness in a new learning environment (Cameron & Rideout, 2020).

Uzezi and Deya (2017) found that peer groups significantly influence academic achievement in many schools. One explanation for this is that students care about being liked and respected by their peers. Students will strive to please peers in academics and other areas (Uzezi & Deya, 2017). Maunder (2018) posited that peer groups could be employed in schools for successful teaching and learning. In certain problem-solving situations, the group may outperform any single individual (Maunder, 2018). Even if one person suggests a solution, it is likely to be debated in the group. Maunder confirmed that group discussion is a social part of develop reasoning, logic, leadership and problem-solving skills. Hence, social interaction in peer group activities and membership in campus leadership programs are salient activities for students to develop belongingness to the classroom environment (Ahn & Davis, 2020; Davis et al., 2019).

Belongingness to the Campus Community

Belongingness to a campus community refers to students' subjective sense of worth and respect generated from a reciprocal connection with the campus community based on shared experiences, beliefs, or personal attributes (Davis et al., 2019). These feelings of external connectivity are rooted in the context of the referent group one wishes to join. Belongingness to a campus community has been identified as a core dimension of the social inclusion of a student in a school community (Wagle et al., 2021). Learning communities or cohort programs are established to improve students' academic performance, connect them socially, improve their

academics, and strengthen their engagement with a college community (Johnson et al., 2020). A quantitative study of first-year science, technology, engineering, and mathematics (STEM) students ($N = 270$) showed an increase in belongingness to the campus community, and commitment, with overall higher passing rates on first-year STEM courses (Johnson et al., 2020).

Cohort Effect on Belongingness

Diversifying the pool of engineering students involves the exploration of the historical, gender, and cultural norms of engineering (Lakin et al., 2020). However, some students may have conflicting cultural and gender norms. In previous research, students who believed their social identities or latent qualities contradicted stated engineering norms or ways of being experienced a sense of alienation (Lakin et al., 2020). In higher education, student retention in the science, technology, and engineering subjects is a significant challenge—having belongingness has been found to correlate with students' overall performance and retention (Loose & Vasquez-Echeverría, 2021).

In addition, academic performance has been linked to students' belongingness within their academic group (Loose & Vasquez-Echeverría, 2021). For example, Cohen and Kelly (2020) studied college students in a mathematics cohort class and discovered that increasing students' belongingness in the mathematic class increased the desire to continue mathematics in the future. Further, Godwin and Kirn (2020) noted that for engineering students enrolled in cohort classes, their engineering identities were related to belongingness, persistence and academic performance.

Mattering

Mattering, like relatedness, is a component of belongingness. The concept of mattering

has been defined as a type of external affirmation of an individual by others, both on a personal and societal level (Cheat & Li, 2020; Cole et al., 2020). Higher education researchers and practitioners have repeatedly highlighted the importance and influence of mattering on belongingness for college student performance and retention (Schlossberg, 1981). However, despite being proposed more than 30 years ago, mattering has received little attention (Cole et al., 2020). Mattering is exhibited at the societal level through perceptions of indispensability within specific social organizations—for example, community, religion, government, university, or society. Cheat and Li (2020) found three unique components relevant in mattering: (a) importance—the belief that others care about what one thinks, wants, and has to say; (b) that others serve as one's ego-extension—the feeling that others are proud of one's successes and saddened by one's failures; and finally, (c) dependence—the realization that others depend or rely on one's efforts.

Schlossberg (1981) claimed a fourth aspect to mattering: appreciation, or the sense of being recognized for one's efforts by significant others and those in positions of authority. Mattering occurs when one's opinions matter to others, when one is the center of others' attention, and when one is cared about and appreciated by others (Barclay, 2017). People can feel excluded or detached when they believe they do not matter. For some students, this sense of insignificance can lead to existential meaninglessness, social isolation, and self-destructive conduct or dropout decisions. Students who have a sense of social purpose and significance in their lives, on the other hand, are more likely to feel important to crucial people in their lives, including those in a college context, resulting in increased belongingness (Barclay, 2017; Baumeister & Leary, 1995).

Mattering has also been described as a profound factor in social integration (Smith et al.,

2021). Smith et al. believed that mattering could operate as an incentive in and of itself, guiding conduct. Further, mattering has been considered a part of a person's self-concept, affecting psychological well-being (Cameron & Rideout, 2020). Depressive symptoms, anxiety, low self-esteem, suicide ideation, and overall psychological discomfort have all been linked to a low self-concept and a low sense of interpersonal and societal mattering. High mattering experiences, Schriver and Harr Kulynych (2021) noted, are a symptom of a healthy self-concept. Flett et al. (2021) noted that the degree to which people believe they matter to others is taught in the socialization process, which shows people how to behave as human beings. However, people may find themselves in different positions along the mattering continuum because of their socialization experiences (Pychyl et al., 2022). Some people may believe they are vital: others have paid them attention, invested in them, and relied on them. In contrast, some people may have learned through interaction with other that they are less vital. Thus, their position along this dimension helps explain variations in developing belongingness.

Flett et al. (2021) stated that two distinct learned socialization processes influence self-awareness and, thus, views of what matters to others. The two processes are termed *reflected assessments* and *social comparisons*. Reflected assessments are the most potent source of mattering and are characterized as the reactions a person perceives in others, including how others make sense of the person and how the person internalizes others' reactions (Flett et al., 2021). The second socialization process that affects mattering is social comparison, described as a person's self-concept, consisting of the social comparisons made in comparing oneself to others and the way one internalizes these comparisons.

Schwartz (2019) argued that mattering is a feature of identity arising from interpersonal encounters involving validation from others; such validations allow one to feel secure about

one's identity. Without such connection with others, there would be no sense of mattering, no complete sense of self, and no belongingness development. Additionally, students who feel social purpose and significance are likelier to feel important to others, developing belongingness, especially in a college campus environment (Flett et al., 2021).

Out-of-Classroom Experiences

Activities outside the classroom are crucial to students' overall experiences, maybe even more important than academic program characteristics (Hopkins et al., 2021). For example, in a study of service-learning projects, Pichon (2021) suggested that out-of-classroom projects may help students integrate into their learning communities and institutions and develop a sense of belonging. Hence, out-of-classroom activities seem to be growing more popular, allowing institutions to expand efforts to help students develop social, emotional, and interpersonal skills outside the classroom (Hope, 2021).

Because employment sometimes interferes with students' capacity to participate in out-of-classroom activities, Hope (2021) mentioned on-campus and off-campus work as an exception to the mentioned definition of out-of-classroom experiences. Leadership in a student organization is another out-of-classroom activity, although it has been one of the least explored to date. However, Hopkins et al. (2021) noted that much research exists on student leadership and student leadership programs in general (Hopkins et al., 2021). Students who participate in out-of-classroom activities make a difference in their persistence as they connect to the school and faculty, becoming part of community relationships established by engaging in out-of-classroom experiences (Hopkins et al., 2021). Moreover, several out-of-classroom activities have positively affected first-year persistence, academic performance, and belongingness (Johnson et al., 2020).

Belongingness to the 4-Year Institution

The need for increased participation in engineering, community colleges, and universities has prompted articulation agreements to create programs making community colleges a viable pathway to a 4-year institution (Worsham et al., 2021). One such program is Texas A&M EA. However, compared to students starting directly at 4-year institutions, community college transfer students tend to experience a transition shock that can affect their academic performance (Zhang, 2021). Research on community college pathways has been sparse compared to research on students starting directly at a 4-year institution. For example, Zhang found from quantitative research on transfer students ($N = 681$) that being female, Asian, and from high socioeconomic status was associated with a higher probability of graduating. Additionally, students who participated in high-impact activities, such as community-based projects and mentoring arranged by the instruction, had a higher probability of graduating (Johnson et al., 2020).

Direct faculty and staff interactions are essential for students to navigate academic expectations and develop academic negotiation skills and persistence toward graduation (Schudde et al., 2021b). Additionally, supportive positive interactions with faculty and staff contribute to improved belongingness and retention for first-generation students and students of low socioeconomic status. Further, Cohen and Kelly (2020) noted that faculty and staff function as persistence motivators when students take remedial courses, fail a class, or are put on academic probation. Strayhorn (2018) found that support from college advisors and caring staff members creates a supportive environment and belongingness to the institution for students at risk of leaving college.

Transfer students' expectations about the transition from community college to a 4-year institution make a difference in their engineering identity development and sense of community

and belongingness (Zuckerman & Lo, 2021). Zuckerman and Lo noted that many community college students are extrinsically motivated, primarily by high GPA scores, which can reduce their engagement in campus communities and narrowly focus them on academic success (Strayhorn, 2018). Strayhorn indicated that transfer students' diminished focus on on-campus community engagement could negatively influence their identity construct and belongingness among peers and faculty. Moreover, compared to direct campus students, transfer students must seek experiences with faculty and peers to construct an identity, attain belongingness, and persist toward graduation (Zuckerman & Lo, 2021).

Persistence at Community College

Community college persistence is a critical and recurring topic. Many researchers have highlighted the challenge of low graduation rates for students enrolled in community college institutions (Hatch & Garcia, 2017). Although academics have made progress in identifying characteristics that influence students' ability to persist, data show that attrition in community colleges may start as early as the first term, even before the first day of class (Hatch & Garcia, 2017). In addition, most studies have focused on 4-year institutions with different admissions processes compared to community colleges. At community colleges, for example, students frequently enroll within a few weeks or days of the first class (Huntington-Klein et al., 2017).

Students enroll in community college for various reasons, including completing an associate degree, transferring, or both, and sometimes take only single courses as needed for transfer credit at another institution where they are concurrently enrolled (Hatch & Garcia, 2017). Some enroll for personal enrichment, to acquire specific skills, or to explore interests and opportunities. Hatch and Garcia noted that academic advising is highly connected to student persistence in community colleges. Academic advising is one of the few organized programs

available in community colleges that ensure students have engagement with institution staff.

Moreover, Murphy et al. (2020) researched if persistence increased after a first belongingness intervention aimed at underrepresented students at a broad-access university in the Midwest. According to the quantitative assessments (N = 1,063), student persistence increased, as evidenced by continuous enrollment over the subsequent four semesters. In addition, students attending the first year of belongingness intervention experienced an increased sense of academic and social fit (Murphy et al., 2020). Hence, belongingness interventions foster equity, increase students' GPAs, and unlock students' potential to persist (Binning et al., 2020). Additionally, Garza et al. (2021) reported that students' belongingness directly and substantially influenced their persistence in enrollment choices.

Further, socio-academic integrative moments had a direct and considerable favorable influence on students' feelings of belongingness. Garza et al. (2021) argued that learning communities strongly and positively influenced socio-academic development and feelings of belongingness. Likewise, Marra et al. (2009) found that belongingness was the salient factor for a decision to persist, and retention was affected by students' self-efficacy.

Institutional Partnership for Transition College Pathways

Community colleges have become a valuable transitional pathway to engineering education for students interested in earning a baccalaureate degree but unable to enroll directly in a traditional 4-year university program (Zhang, 2021). Since 2015, Texas A&M University has collaborated with six community colleges in Texas in creating the Engineering Academies as a transition college pathway program. The Texas A&M University Engineering Academies program is unique in allowing co-enrolled students outside the main campus to enroll in Texas A&M engineering courses taught by Texas A&M faculty and in accepting all community college

program courses taught by their faculty. However, community college engineering students often have family responsibilities, hold part-time jobs, and interact less often with other students outside the classroom, negatively influencing the establishment of belongingness and decreasing persistence (Cohen & Kelly, 2020).

Cole et al. (2020) noted that belongingness to a place such as a classroom or a campus community creates cohesion among students participating in a college transition program. Therefore, because the formation of belongingness is different for students at a community college than for students at a traditional 4-year institutions, researchers have proposed that when students in a college transition program experience a friendly classroom culture, supportive campus environment, and a warm welcome to the university, their feeling of belongingness increases (Cohen & Kelly, 2020; Daddona et al., 2021). Hence, following a structured community college pathway program as an entry point toward a 4-year degree instead of a typical transfer process is salient to students' belongingness and persistence development (Dinh & Zhang, 2021; Zhang, 2021).

Specifically at Texas A&M, EA community college pathway program, many factors influence a first-year student's persistence. For example, being located at a partner community college first year may result in less social integration and experience a lack of rites of passage into the 4-year institution. Therefore, evaluating students' belongingness in the classroom, with the campus community, and with the institution are essential when investigating how belongingness relates to persistence for first-year students in the Texas A&M EA program.

Chapter Summary

The literature review provided insight into current knowledge on the relationship between belongingness and persistence. In addition, the literature review identified a significant amount

of research revealing evidence of the relationship between belongingness and persistence for college students; in fact, this relationship has been cited repeatedly in research on motivation, goals, persistence, and retention (Geisinger & Raman, 2013; Kendall et al., 2019; Scheidt et al., 2021).

However, research has shown that a determination to complete a task or goal does not guarantee persistence toward completion (Campbell et al., 2021). Instead, social integration and belongingness affect persistence formation in students for goal completion (Han et al., 2022; Strayhorn, 2018; Tinto, 2022). The prevalent persistence formation occurs when on-campus students establish belongingness to the classroom, the institution, and the campus community. Thus, a gap in the literature emerged regarding EA first-year students at community colleges on belongingness and persistence. Although several studies have been conducted on the effect of belongingness on persistence for 4-year institutions, the purpose of this study was determining the effect of belongingness on persistence for Texas A&M EA students.

With a national graduation rate for engineering students around 50% and less for students transferring from a community college, leaders at Texas A&M could benefit from a better understanding of the reasons behind first-year EA students' persistence (Zhang, 2021). In addition, the literature has recommended further study on belongingness for first-year students at community colleges (Gopalan & Brady, 2020; National Academies of Sciences, Engineering, and Medicine, 2021; Scheidt et al., 2021). Therefore, this study was designed to address the current gap in the literature and expand existing research by examining the relationship between belongingness and persistence of first-year EA students at Texas A&M. The research methodology and design are presented in Chapter 3, which describes the procedures used to explore the correlation between three factors of belongingness and persistence of EA students.

Chapter 3: Methodology

A growing need exists in the United States (U.S.) workforce for professionals practicing engineering. The U.S. Bureau of Labor Statistics has predicted that 140,000 new engineering jobs will be created by 2026 (Torpey, 2018). In response to the increasing need for engineers, Texas A&M University (Texas A&M) established in 2015 the Engineering Academies (EA) a co-enrollment engineering program with selected community colleges in Texas to ease access to 4-year engineering education. The problem addressed in this study was a lack of knowledge about why Texas A&M EA students' first-year retention rates have been consistently about 10% lower than the rates for on-campus students (Retention and Graduation, n.d.).

Researchers have suggested that sociological noncognitive factors such as belongingness may affect students' decisions to persist or leave engineering (Louten, 2022). Therefore, the purpose of this quantitative correlational study was to examine the statistical relationships for three separate constructs of belongingness: (a) the classroom, (b) the university as a community, and (c) the university as an institution in relation to EA student persistence. A study of these statistical relationships could contribute to the knowledge base for how belongingness correlates to persistence for first year retention among EA students at 2-year and 4-year institutions (Gopalan & Brady, 2020; Zhang, 2021).

Chapter 3 describes the research methodology, design, and rationale for this study. The problem and purpose statements of the study, research questions, and hypotheses addressed by the study are reiterated. The research methodology section outlines the statistical method used to examine the research questions. The research design section discusses the role of the researcher, research procedures, population, collection of survey data, analysis, reliability and validity of the instruments, and ethical procedures. The chapter closes with a summary.

Research Questions and Hypotheses

The following research questions guided this study:

Research Question 1: To what extent is there a statistically significant relationship between belongingness to the classroom and persistence among Engineering Academies students?

Research Question 2: To what extent is there a statistically significant relationship between belongingness to the university as a community and persistence among Engineering Academies students?

Research Question 3: To what extent is there a statistically significant relationship between belongingness to the university as an institution (4-year institution) and persistence among Engineering Academies students?

The following research hypotheses were applied to determine the level of significant correlation relationships between belongingness and persistence:

$H1_0$: There is no statistically significant correlation between belongingness to the classroom and persistence among Engineering Academies students.

$H1_a$: There is a statistically significant correlation between belongingness to the classroom and persistence among Engineering Academies students.

$H2_0$: There is no statistically significant correlation between belongingness to the university as a community and persistence among Engineering Academies students.

$H2_a$: There is a statistically significant correlation between belongingness to the university as a community and persistence among Engineering Academies students.

$H3_0$: There is no statistically significant correlation between belonging to the university as an institution (4-year institution) and persistence among Engineering Academies students.

$H3_a$: There is a statistically significant correlation between belonging to the university as an institution (4-year institution) and persistence among Engineering Academies students.

Research Methodology, Design, and Rationale

The selected quantitative methodology is based on a scientific philosophy commonly used to investigate a social phenomenon. The study used a highly structured deductive approach to collect quantitative data (Ragab & Arisha, 2018). A quantitative approach is rooted in an objectivist ontological view that a single reality exists independent of human perception (Babones, 2016). Additionally, the study is situated in a positivism paradigm of collecting and analyzing data without the interference of the researcher (Hothersall, 2019). Finally, the study aims to develop knowledge about first year-retention of EA students from the correlational analysis of the three factors of belongingness and persistence.

Methodology

The study used a quantitative methodology to examine the strength of the association between variables found in quantifiable numerical data. A quantitative methodology uses mathematical models and statistical analysis methods to predict patterns and provide results for inferences to larger populations (Creswell & Guetterman, 2019; Gravetter et al., 2020; Schober et al., 2018). Moreover, a quantitative methodology aligns with a detailed, structured, deductive research approach in accordance with the student integration theory chosen for this study (Coccia, 2018; Trochim & Donnelly, 2006).

In contrast to a quantitative methodology, a qualitative methodology is based on a humanistic paradigm seen from an ontological view of subjectivism wherein multiple realities exist (Ragab & Arisha, 2018). Moreover, qualitative methods aim to construct meaning from words and interactions with the phenomena and use thematic and content analysis to examine

themes or patterns from collected data (Lessnoff, 2021). The qualitative method is not intended to explore the causal relationship between variables but rather to advance understanding and gain knowledge of a phenomenon from interviews, surveys, observation, or document analysis (Creswell & Guetterman, 2019). Even though qualitative methods might offer a greater detail of human experiences, they are less useful for generalizations (Coccia, 2018). A qualitative study would not have answered the research questions regarding whether a relationship exists between belongingness and persistence in engineering academies students. Therefore, a qualitative method was not an appropriate methodology for this study.

Design

For this quantitative study, a correlational design was the most appropriate to examine the relationship-based research questions regarding whether relationships exist between the pairs of variables. A correlational design uses survey data and statistical analysis methods to determine if a correlation relationship exists and to assess the statistical strength of the relationships between dependent and independent variables (Creswell & Guetterman, 2019). This research study used four variables. One dependent variable was adapted from the College Persistence Questionnaire (Davidson et al., 2009), and three independent variables were adapted from a scale used in previous research to measure belonging (Anderson-Butcher & Conroy, 2002; Lounsbury & DeNeui, 1996; Smith et al., 2012).

Moreover, these variables were not intended to be controlled or manipulated; therefore, the selected correlational design was nonexperimental and thus considered appropriate for this study (Gravetter et al., 2020). As mentioned, statistical significance and rejection of null hypotheses do not lead to an interpretation of causality. This correlational design aligns well with other research studies with similar variables, theoretical frameworks, and college students at

different locations (Gopalan & Brady, 2020; Zhang, 2021).

The advantage of a correlational design based on a deductive approach was two-fold: (a) validity can be established in theories for the phenomenon, and (b) results can be generalized to a larger population. Further, correlational designs can produce meaningful results for direct practical applications as well as serve as a foundation for future experimental studies (Giordano et al., 2021). Survey methods make it relatively affordable and easy to reach and collect data from a large number of participants in a relatively short time. Applying standardized statistical methods means the statistical model and analysis are accurate and replicable (Creswell & Guetterman, 2019).

The aim of this study was not suited to other quantitative research designs, such as causal-comparative, quasi-experimental, or experimental because they would not have examined the correlation or strength among the variables in this study (Gujarati, 2019). In addition, qualitative methods were not suitable because they are limited to fewer participants and are more time-consuming. In sum, using a qualitative method or a quantitative research design other than a correlational design would not have tested the hypotheses and therefore would have failed to expand the literature regarding the relationship between belongingness and academic persistence for EA co-enrolled students.

Variables

This study centered on four variables: (a) three independent and (b) one dependent. The independent variables measured belongingness in the classroom, university as a community, and university as an institution, using a subset of Anderson-Butcher and Conroy's (2002) measure for belonging and Lounsbury and DeNeui's (1996) measure for sense of community. The dependent variable measured persistence using the College Persistence Questionnaire (Davidson et al.,

2009). Participants self-reported these variables through online surveys, using a 5-point Likert scale.

Statistical Test

The statistical test consisted of the Pearson product-moment correlation coefficient based on covariance (Schober et al., 2018). Pearson product-moment correlation is a predictable method for examining the association between independent variable and dependent variable (Gujarati, 2019). Further, Gujarati (2019) noted that the Pearson product-moment correlation gives the strength and direction results between independent variable and dependent variable. The statistical test is purely correlational; causality is not included.

Role of the Researcher

The researcher chooses the methodology, design, reliability and validity efforts, sample size, data collection procedures, and instrument, with the aim of examining the research questions (Taguchi, 2018). In addition, the researcher manages the research project and ensures compliance with ethical procedures in plan, proposal, execution, presentation, and publication of results (Peled-Raz et al., 2021). For this study, I determined the sample size using the G*Power software program (Faul et al., 2009).

Approval to conduct this study was obtained from the Institutional Review Board (IRB) of the American College of Education (ACE) and the IRB of Texas A&M University prior to data collection (Appendix A). I was not located at potential participants' campuses and had no role related to the research participants. It is important to note that participants were recruited through academic advisors responsible for each Engineering Academies location; therefore, I was not involved in the data collection. After the survey ended, I analyzed the collected data and managed data security by storing the data on an external hard drive with password protection.

Research Procedures

Research procedures for the study included selecting the population and sample, adapting the survey instrument, and collecting and preparing data. An online survey was used for the survey design, distribution, and collection. An online survey is suitable for descriptive research of a cohort (Nayak & Narayan, 2019). Nayak and Narayan noted that online surveys could have a low response rate because participants might choose not to answer questions; in this case, responses with missing data were not included in the data analyses. Data sufficient for independent and replicable statistical analyses were collected and stored electronically with password protection and with no participant personal identification. The academic advisors at Texas A&M University sent the prospective participants a recruitment email containing a link to the informed consent form and a secure and anonymous survey. Participants were required to give their informed consent before being granted access to the survey.

Population and Sample Selection

The target population for the study was first-year engineering students at Texas A&M Engineering Academies located in San Antonio, Austin, Dallas, Midland, and Blinn in Texas. The data collection method was SurveyMonkey, a web-based tool. SurveyMonkey is designed for online surveys and gathering data (Abd Halim et al., 2018). Web-based surveys are a well-established method of survey implementation (Daikeler et al., 2020). Daikeler et al. noted that web surveys are useful when surveying a specific population, such as employees and students with institutional email addresses. Moreover, the advantages of using web surveys include survey design flexibility, controlled sampling, quick response time, and ease of data gathering (Daikeler et al., 2020; Reips & Buchanan, 2021). However, web-based surveys yield lower response rates than traditional methods. For example, Daikeler et al. found a difference of 12%

in response rates compared to mail and telephone surveys. Further, web-based and email survey invitations can be overlooked or routed to spam filters and thus made unavailable (Daikeler et al., 2020).

In this study, participants were recruited through the academic advisor responsible for each Engineering Academies location. Participants received an email with an overview of the study and consent form from the A&M Engineering Academies advisors. After signing the consent to participate, participants accessed the online survey on their computers. The total population available for the study consisted of 322 first-year EA students. The G*Power software program was used to establish the required sample size for the Pearson product-moment correlation analysis (Kang, 2021). For an alpha value of .05, a moderate correlation, and a power level of .90, the needed sample size was 112 respondents (Appendix B). Data gathering continued for 3 weeks, and then the analysis proceeded with whatever number of respondents had agreed to participate. In addition, Kang (2021) noted that sample size determines the number of participants needed to avoid Type II errors in the statistical analysis. In hypothesis testing, a Type II error is when a statistical data test fails to reject the false null hypothesis when it is false (Gravetter et al., 2020). Therefore, the power analysis for the Pearson product-moment correlation was performed using G*Power to determine a sufficient sample size of students with a power of .90, alpha value of .05, an effect size of $p = .05$, and a two-tailed test (Hedberg, 2018; Kang, 2021).

Instrumentation

This quantitative correlational study employed an online survey to collect the values of three factors for belongingness and persistence. The belongingness survey for this study was a subset of Anderson-Butcher and Conroy's (2002) measure of belonging and Lounsbury and

DeNeui's (1996) measure of psychological sense of community (PSC). Further, the College Persistence Questionnaire (CPQ) was used as the persistence measure (Davidson et al., 2009). The measures of belonging in higher education and the CPQ instruments comprised four 5-item Likert scales designed to collect numerical data for affective values for belonging and persistence (Davidson et al., 2009; Smith et al., 2012). The participants responded to the survey questions with scores ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Using reliable and valid surveys ensured the study's accuracy and trustworthiness (Creswell & Guetterman, 2019).

Validity and reliability are salient concerns of the survey method (Taber, 2018). Validity is related to the degree to which the survey questions measure what they claim to measure, and reliability occurs when consistent outcomes are reported when repeated (Bujang et al., 2018). Surveys cannot be valid without being reliable, but reliability does not depend on or ensure validity (Gravetter et al., 2020). Cronbach's alpha, an objective indicator for multi-item scales, is an index for reliability, calculated and reported numerically with scores between zero and one. A high numerical value for alpha indicates a reliable scale, showing all the items measure the same affective values. Acceptable alpha values in this study ranged between .70 and .90 (DeVellis, 2022).

Belongingness to the Classroom Variable—A 4-Item Subscale Survey

The independent variable for belongingness to the classroom was consistent with Smith et al.'s (2012) study on engineering and science first-years' belongingness, which used a 4-item subscale survey from Anderson-Butcher and Conroy's (2002) measure of belonging. Smith et al. (2012) used this survey in a nonlongitudinal study of more than 900 students located at five different colleges. Wilson et al. (2015) used the same 4-item subscale survey for 1,500 students

in STEM courses. Both studies noted alphas of .89. Zhao et al. (2019) noted an alpha of .88 for the same 4-item subscale survey for 368 first-year students from three different institutions. Thus, the 4-item subscale has consistently demonstrated alphas greater than .70. Permission to use the instruments was granted (Appendix C).

Belongingness to the University as a Community Variable—A 3-Item Subscale Survey

The independent variable for belongingness to the university as a community was consistent with Smith et al.'s (2012) study on engineering and science first-years' belongingness. Smith et al. used a 3-item subscale survey from Lounsbury and DeNeui's (1996) measure of psychological sense of community (PSC). Their research noted an alpha of .90 for first-year students. Smith et al. used a nonlongitudinal study to survey more than 900 students at five different colleges, and Wilson et al. (2015) used the same 3-item subscale survey for 1,500 students in STEM courses. Both studies noted alphas of .86. Thus, the 3-item subscale has consistently demonstrated alphas greater than .70. Permission to use the instruments was granted (Appendix C).

Belongingness to the University as an Institution Variable—A 4-Item Subscale Survey

The independent variable for belonging to the university as an institution was consistent with Smith et al.'s (2012) study on engineering and science first-years' belonging, using a 4-item subscale survey from Anderson-Butcher and Conroy's (2002) measure of belonging. Smith et al. (2012) used this survey in a nonlongitudinal study of more than 900 students located at five different colleges. Wilson et al. (2015) used the same 4-item subscale survey for 1,500 students in STEM courses. Both studies noted alphas of .87. Thus, the 4-item subscale has consistently demonstrated alphas greater than .70. Permission to use the instruments was granted (Appendix C).

Persistence Variable—A 4-Item Subscale Survey

The College Persistence Questionnaire (CPQ) is a well-established 32-item instrument developed to predict student attrition (Davidson et al., 2009). Several factors have shown statistical significance for attrition in the CPQ, including institution commitment, academic integration, and academic conscientiousness, with the institutional commitment factor as an accurate predictor of persistence (Davidson et al., 2009). Davidson noted that students who scored high on the institutional commitment subscale were far more likely to persist; therefore, this study used the 4-item subscale for institutional commitment to predict persistence. The survey has demonstrated reliability for several studies. Arbona (2016) and García-Ros et al. (2019) noted alphas of .78. Permission to use the CPQ was obtained from the author (Appendix C).

Instrument Validation

Based on literature on belongingness and persistence, the instruments used to collect data for the variables in this study were evaluated to have reliable alpha values (Davidson et al., 2009; Smith et al., 2012). Specifically, the instruments had alpha values between .70 and .90. Therefore, these four instruments were employed to answer this study's research questions. Data collected from the belonging survey consisted of the three independent variables of belonging. Data collected from the persistence survey instrument constituted the dependent variable in this study.

Data Collection

Survey participants often use their own computers and preferred web browsers for web-based surveys, a process that differs from the process used in lab-based surveys, in which all participants use the same computer system (Anwyl-Irvine et al., 2020). However, Anwyl-Irvine

et al. found that modern web browsers and computers provide acceptable online performance and that no single computer system negatively affects data collection. Data collection was initiated after ACE Institutional Review Board (IRB) approval. Potential participants were recruited through the academic advisors responsible for each Engineering Academy location. Participants received an email from their academic advisors containing an overview of the study and a consent form. The consent form informed the respondents about the study, addressed privacy concerns, and let them know that participation was voluntary. After participants consented to participate by answering "I consent," the participants were automatically granted access to the survey. Additionally, participants could exit the survey before completion (Evans & Mathur, 2018).

If participants agreed to participate, they received access to the survey containing four survey instruments. There were 12 items for the three belonging scales and four items to collect persistence data. The SurveyMonkey platform was used to collect responses to the survey and to anonymize the data. Online surveys are acceptable for providing anonymity, in compliance with ethical regulations (Creswell & Guetterman, 2019). After the survey was completed, SurveyMonkey showed a thank you note to the participants. Additionally, academic advisors were available to answer questions and support participants after the survey. No personal data or internet protocol (IP) addresses were identified or collected. The SurveyMonkey data were downloaded into a Microsoft Excel spreadsheet and prepared for transmission to Statistical Package for Social Science (SPSS) software for statistical analyses.

Data Preparation

Data preparation is a critical step in the data analysis process (Creswell & Guetterman, 2019). Missing data pose challenges and threats to validity, reliability, and statistical power.

Statistical power is the probability of avoiding a Type II error, a false negative conclusion (Creswell & Guetterman, 2019). Additionally, statistical power can influence Type I error, the decision to reject the null hypothesis when it is actually true (Creswell & Guetterman, 2019). In the data preparation phase, outliers and incomplete surveys were removed using a likewise-deletion process in Microsoft Excel before performing statistical analyses (Cook, 2021). Data files were password-protected, stored in a secure data file, and not shared. The data management followed federal regulations for personal data protection.

Data Analysis

Excel data analysis and SPSS statistical software were used to calculate descriptive and correlational statistical analyses. The purpose of this quantitative correlational study was to examine the statistical relationships for three separate constructs of belongingness: (a) the classroom, (b) the university as a community, and (c) the university as an institution in relation to EA student persistence. Three separate linear regression analyses were performed on each pair of independent and dependent variables to determine correlations. Correlation particulars were determined using linear regression analysis and Pearson product-moment correlation. The output determined statistical significance to evaluate hypotheses for the three research questions.

Statistical Analysis Assumptions

Statistical assumptions were checked and reported to avoid biases or threats to this study's internal validity (Creswell & Guetterman, 2019). To apply Pearson product-moment correlation analysis, the sampled data must be a random and representative sample of the population targeted in this study. Additionally, according to Laerd Statistics (2022), Pearson product-moment correlation analysis has five assumptions: (a) variable pairs need to be measured at the interval or ratio level (b) paired variables (c) linear relationships must exist

between pairs of variables, (d) no significant outliers can appear in the dataset for each variable, and (e) the data sets must be approximately normally distributed. Violations of these assumptions mean the test statistics may not be realistic (Gravetter et al., 2020).

Each variable's interval data were calculated using descriptive analysis from the Likert rating scale. The use of Likert scale data to calculate interval data has been accepted in the literature (Lionello et al., 2021). Linear relationships were tested using a scatterplot of data in Microsoft Excel to verify related pairs of variables. Outliers in the dataset were screened and removed from the dataset using Microsoft Excel data analysis and descriptive data analysis. Additionally, SPSS software was used for normality, skewness, and kurtosis tests. For Pearson product-moment correlation test output to be reliable, the data must satisfy all the tests.

Descriptive Analysis

Descriptive analysis consisted of calculating frequency as percentages, the mean (*M*) as a measure of central tendency, and the standard deviation (*SD*) as a measure of variation in the data sets (Gravetter et al., 2020). Additionally, descriptive statistics were used to determine assumptions for the Pearson product-moment correlation statistical analysis. Kolmogorov–Smirnov and Shapiro–Wilk tests were used to validate the normality and scatterplots to identify outliers in each of the variables' data sets (Laerd Statistics, 2022).

Pearson Product-Moment Correlation Test Output

The test yielded three outputs for each test of variable pairs: (a) Pearson product-moment correlation coefficient, r; (b) coefficient of determination, R^2; and (c) the p value. The Pearson product-moment correlation coefficient r indicated the strength of the correlation and directions; the r value was a unit-free number between −1 and +1, with a positive number indicating a positive relationship and an r <.1 indicating no correlation. The coefficient of determination, R^2,

a unit-free number, indicated the variance between the two variables. A standard significance level (α) of .05 (two-tailed) was used, representing a 95% statistical chance of demonstrating linear relationships. For p values <.05, the correlation was deemed statistically significant, and the null hypothesis was rejected. The conclusion was that a correlation existed. Additionally, the number of participants for each scale (N) appeared in the output.

Reliability and Validity

Establishing trustworthy results from the quantitative correlational analysis depends on the reliability and validity of the surveys (Creswell & Guetterman, 2019). Therefore, addressing threats to reliability and validity was necessary to ensure accurate generalization to a larger population. Additionally, replicable studies using the same surveys for a similar population should yield a similar result (Gravetter et al., 2020). Hence, possible threats to the population data, external, internal validity, reliability, and objectivity were evaluated.

Threats to External Validity

External validity relates to the usefulness of a study's findings for generalizing (Creswell & Guetterman, 2019). Students at the Engineering Academies were commuter students located outside the main campus and commonly had family responsibilities. Therefore, conducting a similar study with on-campus residential students could have yielded different results. Another possible issue was the fact that the study was conducted for first-year EA students. The selection of students with narrow characteristics could represent a threat to external validity, restricting the generalizability of findings (Creswell & Guetterman, 2019). Because of these two issues, the generalization of the study might be restricted. However, given the self-selected sample size of 112 first-year students, the results could be generalized for existing and new Engineering Academies students with similar characteristics.

Threats to Internal Validity

A threat to internal validity of the study could have come from a lack of randomization in sample selection that introduced bias, especially if some groups in the population were more represented compared to others (Creswell & Guetterman, 2019). However, using survey data from participants who had an equal chance to participate mitigated the effect of unequal representation. Additionally, data preparation in eliminating surveys with missing data was critical for internal validity (Gravetter et al., 2020).

Threats to Reliability

Reliability in data is concerned with consistency in data gathering. A threat to reliability could have related to the motivation or mood students might have had at the time of the study, which may not have represented how students felt at other times during the semester (Creswell & Guetterman, 2019). Therefore, students had 3 weeks to complete the survey to minimize the risk of threat to reliability.

Threats to Objectivity

Threats to objectivity can come from unintentional biases when performing a study. Recognizing threats to objectivity requires implementing procedures to increase impartiality (Creswell & Guetterman, 2019). Two potential threats to objectivity could have occurred in two phases of this study: (a) measurement and (b) quantification. Reducing personal biases and independence of perspective in measurement were achieved by collecting participants' self-reported data from online survey instruments.

However, quantifying data from self-reporting online survey instruments and presenting measurement results requires interpretation, which introduces possible bias. Reducing personal biases during interpretation was accomplished by using Pearson product-moment correlation, a

recognized, replicable statistical data analysis tool, to examine the hypotheses (Gravetter et al., 2020).

Ethical Procedures

Three basic principles are particularly relevant to the ethics of research involving human subjects: respect of persons, beneficence, and justice, described in the following subsections (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979). This nonexperimental correlational study was designed to meet the basic ethical principles and applications outlined in the Belmont Report (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979). The principles of the Belmont Report are codified in the United States Code of Federal Regulations Title: 45 Public Welfare, Part 46 (45 CFR 46), which directs all research involving human subjects. The code is governed by the United States Department of Health and Human Services (HHS). The code requires the protection of the rights and welfare of human subjects in research. Protection of human subjects includes obtaining Institutional Review Board (IRB) approval before collecting data. The IRB's role in reviewing and approving human subjects research ensures the research meets federal regulations and institutional ethical standards (Creswell & Guetterman, 2019).

Respect for Persons

Respect for persons requires that individuals in this study be treated as autonomous agents, meaning they can express themselves and make choices independently (Creswell & Guetterman, 2019). Therefore, the study design allowed voluntary participation. Additionally, the study design respected and maintained participants' autonomy throughout the research. During the research process, participants could discontinue participation in the study at any time. In addition, collected variables were not used to identify specific individuals.

Beneficence

Beneficence refers to persons being treated ethically by respecting their decisions, protecting them from harm, and making efforts to secure their well-being (Creswell & Guetterman, 2019). Two rules relate to beneficence: (a) do no harm, and (b) maximize possible benefits and minimize possible harm (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979). Participants were protected under the principle of do no harm by not collecting personal identifiers using SurveyMonkey. SurveyMonkey excludes participants' information and identifies participants using generic numbers. In addition, the study design caused minimal risk to participants because of the nonexperimental design, which used no intervention or manipulation of the independent variables. There were no monetary benefits for participating in the study. However, participants benefited by contributing data to improve first-year students' experiences.

Justice

Justice refers to equal selection and treatment of the population invited for study as well as the benefits of the study outcomes (Creswell & Guetterman, 2019). Justice was applied to participant selection by neither collecting data nor making decisions based on any additional criteria outside of those outlined for inclusion and exclusion. Additionally, justice was upheld by treating each participant equally throughout the study process.

Informed Consent

Respect for persons requires that the invited population be provided with adequate information to participate based on informed consent (Creswell & Guetterman, 2019). Informed consent includes information, comprehension, and voluntariness. Therefore, the research design included an invitation by email to participate (Appendix D). This invitation was followed by an

informed consent form (Appendix E) explaining the specific research information, allowing the targeted population to comprehend and voluntarily participate. The risk of harm to participants was minimal from responding to a set of four surveys (Appendix F) in this nonexperimental correlational study. The selection criteria of the population required participants to be first-year Engineering Academies students. The survey took no more than 15 minutes to complete. In addition, in this study, all data files will be stored securely for 3 years from the conclusion of the study and deleted per federal regulations (Protection of Human Subjects, 2018).

Chapter Summary

Belongingness has emerged as a noncognitive factor determining a student's decision to persist or leave college. The graduation rate for engineering students is approximately 50% and even lower for community college students (Zhang, 2021). The study was designed to examine the statistical relationships for three separate constructs of belongingness: (a) the classroom, (b) the university as a community, and (c) the university as an institution in relation to EA students' persistence. A quantitative correlational research design was selected to investigate the social phenomena of belongingness and persistence. The chosen nonexperimental research design was appropriate because it used quantitative correlational analysis to examine the strength of the associations among variables from a collection of quantifiable numerical data (Gravetter et al., 2020). The instruments for the study ensured alignment with the research questions and hypotheses. Moreover, the instruments ensured the validity and reliability of the quantitative research (Creswell & Guetterman, 2019).

Data were collected from first-year engineering academies students located outside the main university campus. The data for this study were obtained from Texas A&M first-year EA students through an online survey. The data collection method of a web-based survey provided

information for correlational examination and posed a minimal risk to participants. For this study, the participants' identities were not collected. This study proposal was submitted to the American College of Education (ACE) IRB. Approvals by ACE IRB and Texas A&M University IRB were obtained before invitations to students were sent and data collected. After approvals for conducting the study were received, potential participants received a recruitment letter consisting of a consent form, which included a summary of the study. The recruitment letter (Appendix D) and the consent (Appendix E) were distributed to the population through Texas A&M University emails sent from the A&M Engineering Academies advisors. The informed consent form acknowledged participants' rights and communicated the research purpose.

Statistical data analysis from the gathered data follows in Chapter 4. Pearson product-moment correlation statistical data analysis was used to examine the research questions and hypotheses regarding the statistical relationship between belongingness and persistence. The analysis was explicitly a correlation study, and therefore causality is not discussed. Finally, statistical data are presented to support the findings.

Chapter 4: Research Findings and Data Analysis Results

The growing number of U.S. engineering jobs signifies a need for more students to pursue engineering degrees. To increase access to engineering education, Texas A&M University established Engineering Academies (EA) in cooperation with selected community colleges in Texas. The problem addressed in this study was a lack of knowledge about why Texas A&M EA students' first-year retention rates have been consistently about 10% lower than the rates for on-campus students (Retention and Graduation, n.d.). Researchers have suggested that sociological noncognitive factors such as belongingness may affect students' decisions to persist or leave engineering. The purpose of this quantitative correlational study was to examine the statistical relationships for three separate constructs of belongingness: (a) the classroom, (b) the university as a community, and (c) the university as an institution in relation to EA student persistence. Survey data from 155 EA students were collected for this study. The remaining sections of this chapter provide an overview of data collection and statistical analysis with tables and figures to illustrate the narratives. In addition, the chapter presents the findings of the study, followed by a discussion of reliability and validity. The chapter closes with a summary.

Data Collection

The target population from which participants for this research were collected consisted of Texas A&M University first-year EA students at locations in San Antonio, Austin, Dallas, Midland, and Blinn. A total population sampling method was used, which included all first-year EA students enrolled in the program fall 2022 semester. After ACE IRB approval and acceptance by Texas A&M University IRB (Appendix A), academic advisors identified 322 students meeting the participation criteria (Appendix G). The recruitment email (Appendix D), which included the informed consent form and survey, was emailed to the participants identified by the

academic advisors. In addition, reminder emails were sent to all participants two weeks after the initial recruitment email. By the end of the 3-week data-collection period, 169 respondents were registered in the SurveyMonkey database, yielding a 52.51% response rate. From the 169 responses, three participants did not consent to participate, and 11 did not complete the survey. Participants who did not consent were excluded from entering the survey. No information was available about the three respondents who decided not to participate because participants could anonymously exit or withdraw from the survey. Documentation of consent or nonconsent was shown in the SurveyMonkey dataset as a numeric value. The total number of survey respondents for analyses was 155, sufficient to realize the target sample size of $N = 112$ (Appendix B). No deviation from the data-collection plan was initiated or observed.

Data Analysis and Results

The data collected for the study provided the opportunity to analyze the strength of the correlation and directions between the three independent variables of belongingness and the dependent variable of persistence. The findings are limited to first-year EA students at Texas A&M University. All collected data were used to address the study's research questions and hypotheses. Three Pearson product-moment correlation tests were conducted using Statistical Package for the Social Sciences (SPSS) to calculate descriptive statistics, address the research questions, and test the hypotheses. In addition, the analysis was used to verify the reliability and validity of the statistical findings.

Data Screening

Data were screened for missing responses to the variables. Eleven participants did not complete the survey, and SurveyMonkey did not record their survey responses. Outliers were examined from scatterplots, and a decision was made to keep them, resulting in using 155

respondents for the statistical analysis. The decision to keep the outliers assumed that the Pearson product-moment correlation was robust enough to withstand violations of normality from outliers (Havlicek & Peterson, 1976; Norman, 2010).

Participants Demographics

Participant demographics were not a part of the study and therefore not collected. The study focused on the participants attitudes about belongingness and persistence rather than personal characteristics. However, participants were required to confirm on the informed consent they were at least 18 years old before advancing to the survey portion of the electronic instrument (Appendix C).

Descriptive Statistics

Table 1 displays the descriptive statistics for the four scales. The scales were based on a 5-point metric: 1 = *Strongly Disagree* to 5 = *Strongly Agree*. All four scales had mean ratings above 4.00. The highest scale mean was belongingness to the classroom (M = 4.43). Cronbach's alpha reliability coefficient scores greater than .70 and .80 are regarded as acceptable and good, respectively (Gravetter et al., 2020). The reliability coefficients were acceptable ($\alpha > .70$) and good ($\alpha > .80$) for three of the four scales; the persistence scale was the exception ($\alpha = .67$; Table 1). However, according to Taber (2018) and Vaske et al. (2017), as cited in Kamis and Lynch (2020), a Cronbach's alpha value greater than .65 is minimally acceptable in social science research.

Table 1

Psychometric Characteristics for the Summated Scale Scores

Scale	No. of Items	*M*	*SD*	Low	High	Cronbach's α
Persistence	4	4.32	.61	1.25	5.00	.67
Belongingness to the classroom	4	4.43	.61	2.50	5.00	.84
Belongingness to the community	3	4.37	.70	2.00	5.00	.80
Belongingness to the institution	4	4.17	.78	1.25	5.00	.80

Note. $N = 155$.

Assumptions of Data and Parametric Test

According to Laerd Statistics (2022), five statistical assumptions must be met for Pearson product-moment correlation validity and reliability. The five assumptions require (a) two variables measured on a continuous scale, (b) paired variables, (c) a linear relationship between the variables, (d) no significant outliers, and (e) approximately normal distribution among the variables.

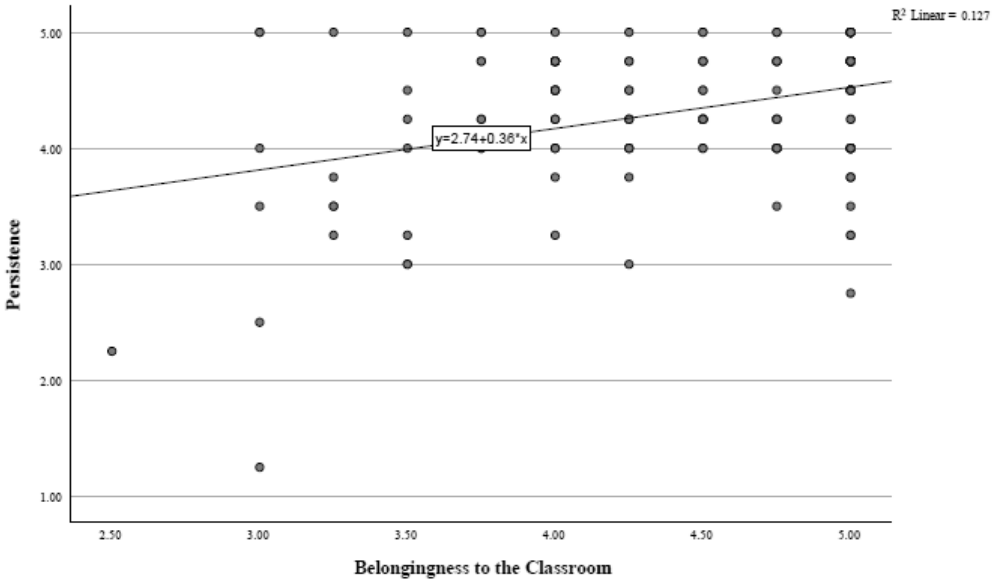
Assumption 1 (continuous variables) was met for the criterion variables by using Likert scales as ordinal data, thus creating approximations for continuous data. The use of the Likert scales as ordinal data has been accepted in correlational studies (Norman, 2010). Assumption 2 (paired variables) was met based on the study's design, which contained one dependent variable and three independent variables. The dependent variable was persistence, and the independent variables were belongingness to the classroom, community, and institution. The survey contained four instruments, one for each variable, measured on a Likert scale. Each independent variable was paired with the dependent variable, establishing three sets of paired variables; hence, the

assumption was met. Assumption 3 (linear relationship between variables) was examined using scatterplots (Figures 1 to 3). Inspection of the scatterplots determined the assumption was adequately met for persistence and belongingness to the institution but less so for the other two variables. Therefore, the findings support a partially met assumption.

Assumption 4 (outliers) was addressed with the scatterplots shown in Figures 1 to 3. There were some outliers and ceiling effects for the criterion variable. A ceiling effect occurs when many respondents have the top rating 5.0 (Gravetter et al., 2020). This effect can potentially minimize the accuracy of the persistence measure because some of those respondents might have had a higher score if the tool had presented a greater range of options than simply 1.0 to 5.0 (Gravetter et al., 2020). With that, this assumption was not met.

Figure 2

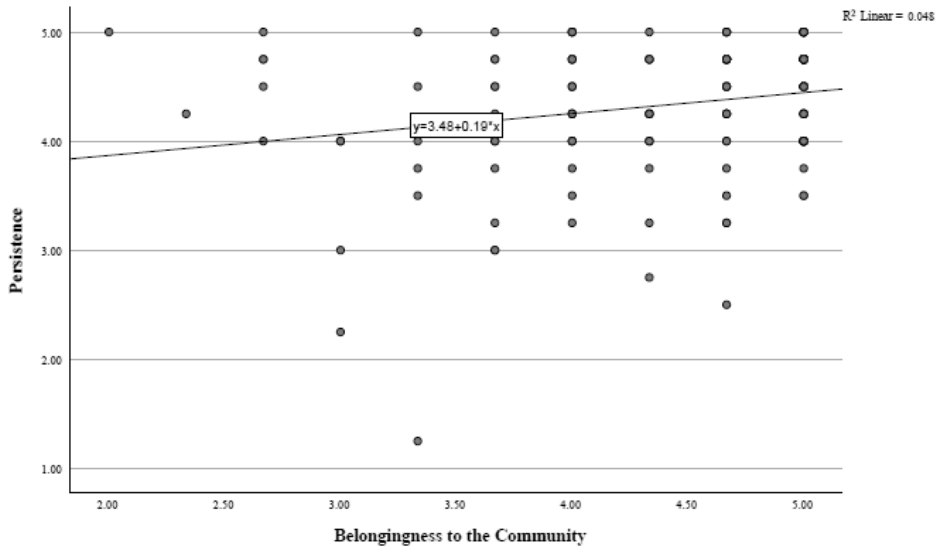
Scatterplots Between Belongingness to the Classroom and Persistence



Note. *N* = 155.

Figure 3

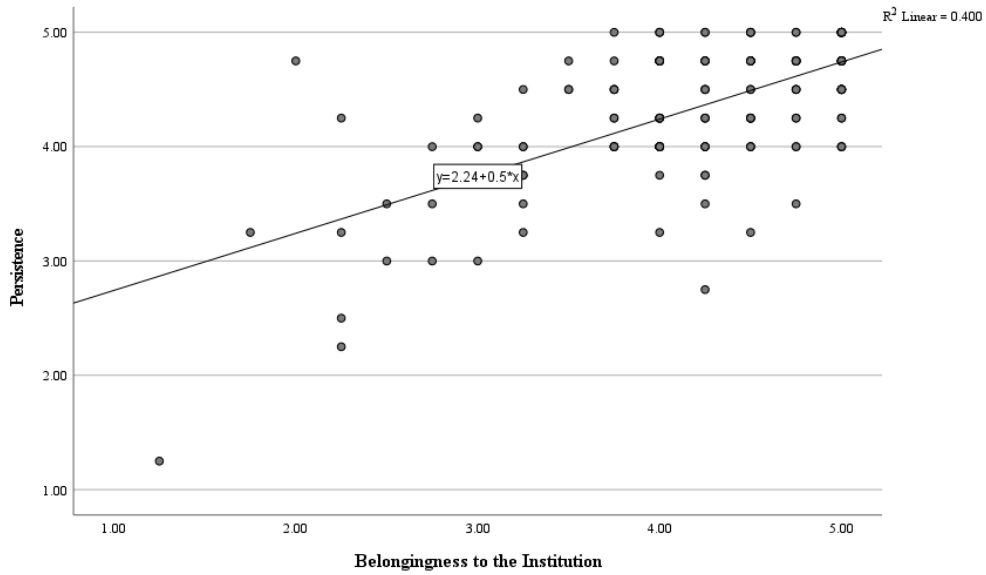
Scatterplots Between Belongingness to the Community and Persistence



Note. *N* = 155.

Figure 4

Scatterplots Between Belongingness to the Institution and Persistence



Note. *N* = 155.

Assumption 5 (the variables must be approximately normally distributed), as shown in Table 2. Kolmogorov–Smirnov and Shapiro–Wilk are nonparametric tests used to validate normality of the variables (Laerd Statistics, 2022). Both tests were performed for the four variables' summated scale scores using SPSS. The Kolmogorov–Smirnov test distribution on the variables scale scores indicated a value less than .05 (p = .001), and the Shapiro–Wilk test on the variables scale scores indicated a value less than .05 (p = .001), which suggests that the scale scores were non-normal in their distribution (Table 2). With that, the assumptions for Pearson product-moment correlation were not met.

Table 2

Normality Statistics for the Summated Scale Scores

	Kolmogorov–Smirnov			Shapiro–Wilk		
Scale	Statistics	*df*	*p*	Statistics	*df*	*p*
Persistence	.16	155	.001	0.86	155	.001
Belongingness to the classroom	.20	155	.001	0.85	155	.001
Belongingness to the community	.22	155	.001	0.84	155	.001
Belongingness to the institution	.17	155	.001	0.88	155	.001

Note: N = 155.

Although Havlicek and Peterson (1976) found Pearson product-moment correlation to be robust toward violation of normality of the variables, Bishara and Hittner (2012) further extended these studies and concluded that Pearson product-moment correlation was robust for a combination of non-normality violations of the variables. Moreover, according to Norman (2010), Pearson product-moment correlations tend to be robust for highly skewed non-normal distributions and small sample sizes. This study required a minimum of 112 respondents and

obtained 155. Still, the violation of assumptions was a concern regarding potential Type II errors, indicating the chance of not rejecting a null hypothesis when it is false (Gravetter et al., 2020).

However, in terms of the robustness of Pearson product-moment correlation, Bishara and Hittner (2012) noted that the most frequent recommendation was to use Spearman rank-order correlation to validate non-normality violations and outliers. Therefore, Spearman rank-order correlations were added for statistical verification purposes (Table 3). According to Laerd Statistics (2022), three statistical assumptions must be met for Spearman rank-order correlations: (a) two continuous or ordinal variables, (b) paired variables, and (c) a monotonic relationship between the variables.

Assumptions 1 (ordinal variables) and 2 (paired variables) were met based on the study's design, identical to the first two assumptions for Pearson product-moment correlation. Assumption 3, the monotonic relationship, was examined and met based on the inspection of the scatterplots (Figures 1 to 3). Taken together, the assumptions for Spearman rank-order correlations were met.

Table 3

Pearson and Spearman Correlations to Test the Hypotheses

	Persistence	
	Pearson Correlations	Spearman Correlations
Belongingness to the classroom	.36****	.23***
Belongingness to the community	.22**	.20**
Belongingness to the institution	.63****	.52****

Note. * $p < .05$. ** $p < .01$. *** $p < .005$. **** $p < .001$; $N = 155$.

Research Questions and Hypotheses Testing

Pearson product-moment correlations were performed to test the research hypotheses in the study. In addition, Spearman rank-order correlations were used for verification of hypotheses testing. The results can be found in Table 3. To achieve the purpose of the quantitative correlational study, the research questions and hypotheses for the study were as follows:

Research Question 1: To what extent is there a statistically significant relationship between belongingness to the classroom and persistence among Engineering Academies students? The related hypotheses stated,

$H1_0$: There is no statistically significant correlation between belongingness to the classroom and persistence among Engineering Academies students.

$H1_a$: There is a statistically significant correlation between belongingness to the classroom and persistence among Engineering Academies students.

To answer the first research question, Pearson product-moment and Spearman rank-order correlations were conducted. Inspection of statistical data identified significant positive correlations based on both the Pearson product-moment correlation, $r(153) = .36$, $p < .001$, and the Spearman rank-order correlation, $r_s(153) = .23$, $p < .005$. This combination of findings provides support for a statistically significant relationship between belongingness to the classroom and persistence among Engineering Academies students. Therefore, the determination was to reject the null hypothesis and accept the alternative hypothesis (Table 3).

Research Question 2: To what extent is there a statistically significant relationship between belongingness to the university as a community and persistence among Engineering Academies students? The related hypotheses stated,

$H2_0$: There is no statistically significant correlation between belongingness to the

university as a community and persistence among Engineering Academies students.

$H2_a$: There is a statistically significant correlation between belongingness to the university as a community and persistence among Engineering Academies students.

To answer the second research question, Pearson product-moment and Spearman rank-order correlations were conducted. Inspection of statistical data identified significant positive correlations based on both the Pearson product-moment correlation, $r(153) = .22$, $p < .01$, and the Spearman rank-order correlation, $r_s(153) = .20$, $p < .01$. This combination of findings provides support for a statistically significant relationship between belongingness to the university as a community and persistence among Engineering Academies students. Therefore, the determination was to reject the null hypothesis and accept the alternative hypothesis (Table 3).

Research Question 3: To what extent is there a statistically significant relationship between belongingness to the university as an institution (4-year institution) and persistence among Engineering Academies students? The related null hypotheses stated,

$H3_0$: There is no statistically significant correlation between belonging to the university as an institution (4-year institution) and persistence among Engineering Academies students.

$H3_a$: There is a statistically significant correlation between belongingness to the university as an institution (4-year institution) and persistence among Engineering Academies students.

To answer the third research question, Pearson product-moment and Spearman rank-order correlations were conducted. Inspection of statistical data identified significant positive correlations based on both the Pearson product-moment correlation, $r(153) = .63$, $p < .001$, and the Spearman rank-order correlation, $r_s(153) = .52$, $p < .001$. This combination of findings

provides support for a statistically significant relationship between belongingness to the university as an institution (4-year institution) and persistence among Engineering Academies students. Therefore, the determination was to reject the null hypothesis and accept the alternative hypothesis (Table 3).

Reliability and Validity

Data for this quantitative correlational study were considered trustworthy for generalizing findings to the Texas A&M EA student population. Establishing trustworthy results for the study was achieved through several methods, including using reliable and validated data-collection instruments, applying objectivity in the form of random and anonymous sampling from the target population, implementing established statistical analysis methods, and measuring significance level (alpha; Creswell & Guetterman, 2019). In addition, employing a self-select participation process using the SurveyMonkey survey over 3 weeks achieved the required sample size. Creswell and Guetterman (2019) advised that self-selection and the ability to decline participation or exit from the study promotes randomization and population representativeness in a sample. In this study, the sample consisted of 155 respondents self-selecting from a population of 322 Texas A&M University EA students aged at least 18 who consented to participate and subsequently completed the survey. The obtained sample size surpassed the minimal sample size of 112 for the study, determined by the G*Power sample size analysis based on a 2-tailed test, an alpha value of .05, a moderate correlation, and a power level of .90 (Appendix B; Kang, 2021).

Obtaining a sample of 155 participants was adequate to achieve statistical power for avoiding Type II errors in hypothesis testing (Appendix B). Statistical power is the increased chance of detecting a true effect and avoiding Type II errors, which indicate the chance of not rejecting a null hypothesis when it is false (Gravetter et al., 2020). Cronbach's alpha analysis

determined the reliability and external validity of the survey instrument. Reliability is rated minimally acceptable, acceptable, and good by Cronbach's alpha coefficient scores greater than .65, .70, and.80, respectively (Kamis & Lynch, 2020). Cronbach's alpha scores in this study indicated good reliability for belongingness to the classroom (α = .84), belongingness to the institution (α = .80), and belongingness to the community (α = .80). For persistence (α = .67), Cronbach's alpha score was determined to have minimally acceptable reliability.

A potential threat to external validity was the risk of selecting participants with specific characteristics, which could have restricted the generalizability of findings (Creswell & Guetterman, 2019). In this study, Texas A&M University first-year EA students located in San Antonio, Austin, Dallas, Midland, and Blinn comprised the defining characteristics of the target population. Ensuring the minimum number of participants needed to reach the power level of .90 (Appendix B) addressed the external threat of generalization for the EA population. However, because of the uniqueness of the program between selected community colleges and Texas A&M University, the findings may not be supported for engineering students in similar programs at other locations. Therefore, claims in the study are restricted to the target Texas A&M University EA student population.

Additionally, internal validity for this nonexperimental correlational study was met by using survey data from self-selected participants, all of whom had an equal chance to participate, thereby ensuring randomization and elimination of selection bias from the population. Moreover, critical to internal validity was the elimination of surveys with missing data (Gravetter et al., 2020); hence, 11 surveys with missing data were eliminated. In sum, according to the evidence of instrument validity and reliability, statistical analyses, and hypothesis testing using Pearson product-moment correlation, including Spearman rank-order correlation for verification, there is

confidence in the interpretations of statistical power to assume a statistically significant correlation between variables. Therefore, no threat exists to the trustworthiness of generalizing findings to the EA student population.

Chapter Summary

This nonexperimental quantitative correlational study used survey research methods to examine the statistical relationships for three separate constructs of belongingness: (a) the classroom, (b) the university as a community, and (c) the university as an institution in relation to persistence in a sample of 155 Texas A&M University EA students. A Pearson product-moment correlation was used to analyze data correlation between persistence as the dependent variable and the independent variables of belongingness to the classroom, community, and institution.

For Research Question 1 (To what extent is there a statistically significant relationship between belongingness to the classroom and persistence among Engineering Academies students?), findings indicate positive statistical significance from Pearson product-moment correlation, $r(153) = .36$, $p < .001$, and the Spearman rank-order correlation, $r_s(153) = .23$, $p < .005$. This combination of findings supports the determination to reject the null hypothesis and accept the alternative hypothesis.

For Research Question 2 (To what extent is there a statistically significant relationship between belongingness to the university as a community and persistence among Engineering Academies students?), findings indicate positive statistical significance from Pearson product-moment correlation, $r(153) = .22$, $p < .01$, and the Spearman rank-order correlation, $r_s(153) = .20$, $p < .01$. This combination of findings supports the determination to reject the null hypothesis and accept the alternative hypothesis.

For Research Question 3 (To what extent is there a statistically significant relationship

between belongingness to the university as an institution [4-year institution] and persistence among Engineering Academies students?), findings indicate positive statistical significance from Pearson product-moment correlation, $r(153) = .63$, $p < .001$, and the Spearman rank-order correlation, $r_s(153) = .52$, $p < .001$. This combination of findings supports the determination to reject the null hypothesis and accept the alternative hypothesis. In the final chapter, the findings are compared to the literature, conclusions are presented, and recommendations are suggested. Additionally, the limitations of the study, recommendations for further study, and implications for leadership are addressed.

Chapter 5: Discussion and Conclusion

Engineering education retention and the decreasing graduation rate are national issues (Huerta-Manzanilla et al., 2021). The problem addressed in this study was a lack of knowledge about why Texas A&M EA students' first-year retention rates have been consistently about 10% lower than the rates for on-campus students (Retention and Graduation, n.d.). Researchers have suggested that sociological noncognitive factors such as belongingness may affect students' decisions to persist or leave engineering. Therefore, the purpose of this quantitative correlational study was to examine the statistical relationships for three separate constructs of belongingness—(a) the classroom, (b) the university as a community, and (c) the university as an institution—in relation to Texas A&M University (Texas A&M) Engineering Academies (EA) students' persistence. The examination was performed by using three Pearson product-moment correlation tests. The three separate constructs of belongingness were the independent variables, and the dependent variable was persistence. The research sample comprised 155 first-year Texas A&M EA students. Data were collected using an online survey open to participants for 3 weeks during the fall semester of 2022.

Three research questions guided this study to determine to what extent a statistically significant correlation existed between the three separate constructs of belongingness and persistence among EA students. The Pearson product-moment correlation tests found a statistically significant correlation between persistence and each of the three constructs. However, because of the violation of assumptions for Pearson product-moment correlation, Spearman rank-order correlation tests were used for verification. This combination of correlational tests was conclusive, leading to the rejection of the three null hypotheses and acceptance of the alternative hypotheses.

Although the results indicated that persistence was associated with belongingness for first-year Texas A&M EA engineering students, they do not imply any causal effects. However, evidence of the correlation strength and direction between the three belongingness constructs and persistence could help Texas A&M Engineering Academies' leaders improve programs and practices to increase first-year retention. In addition, the study's results contribute to the body of knowledge concerning belongingness and persistence for first-year engineering students enrolled in alternative pathway programs to a 4-year college education.

This chapter presents a summary of findings, interpretations, and conclusions from the data presented in Chapter 4. It clarifies the limitations and particular applications of theory to practice and offers implications for leadership. Included in this chapter are recommendations for future researchers grounded in this study, recommendations for changes in practices for leaders of Texas A&M Engineering Academies, and the conclusion.

Findings, Interpretations, and Conclusions

Data analysis results from Chapter 4 provide the basis for the findings and interpretations of this study's research questions and hypotheses. The literature review presented in Chapter 2 supports the interpretation of findings confirming, disconfirming, and extending the body of knowledge. In addition, the theoretical framework provides context for the results and conclusions drawn from the study's findings.

Findings

Research Question 1 examined to what extent there was a statistically significant relationship between belongingness to the classroom and persistence among Engineering Academies students. The Pearson product-moment correlation analysis showed a statistically significant relationship between belongingness to the classroom and persistence among EA

students. Tests for the normality of the data sets were performed, which showed that the Pearson product-moment assumption was violated while the conditions for using the Spearman rank-order test were satisfied.

The results of the test's statistical data identified significant positive correlations based on the Pearson product-moment correlation, $r(153) = .36$, $p < .001$ and verified by Spearman rank-order correlation, $r_s(153) = .23$, $p < .005$. The violation and assumptions yielded no significant difference in the outcome of the Pearson product-moment correlation analysis for hypothesis testing. Hence, the determination was to reject the null hypothesis and accept the alternative hypothesis.

Research Question 2 examined to what extent there was statistically significant relationship between belongingness to the university as a community and persistence among Engineering Academies students. The Pearson product-moment correlation analysis showed a statistically significant relationship between belongingness to the university as a community and persistence among EA students. Tests for the normality of the data sets were performed, which showed that the Pearson product-moment assumption was violated while the conditions for using the Spearman rank-order test were satisfied.

The results of the test's statistical data identified significant positive correlations based on the Pearson product-moment correlation, $r(153) = .22$, $p < .01$ and verified by Spearman rank-order correlation, $r_s(153) = .20$, $p < .01$. The violation and assumptions yielded no significant difference in the outcome of the Pearson product-moment correlation analysis for hypothesis testing. Hence, the determination was to reject the null hypothesis and accept the alternative hypothesis.

Research Question 3 examined to what extent there was a statistically significant

relationship between belongingness to the university as an institution (4-year institution) and persistence among Engineering Academies students. The Pearson product-moment correlation analysis showed a statistically significant relationship between belongingness to the university as an institution and persistence among EA students. Tests for the normality of the data sets were performed, which showed that the Pearson product-moment assumption was violated while the conditions for using the Spearman rank-order test were satisfied.

The results of the statistical data identified significant positive correlations based on the Pearson product-moment correlation, $r(153) = .63$, $p < .001$ and verified by Spearman rank-order correlation, $r_s(153) = .52$, $p < .001$. The violation and assumptions yielded no significant difference in the outcome of the Pearson product-moment correlation analysis for hypothesis testing. Hence, the determination was to reject the null hypothesis and accept the alternative hypothesis.

Interpretations

To interpret and evaluate the findings of the study, the findings are first compared to previous research findings and conclusions on belongingness and persistence. Next, connections are made between the findings and the theoretical frameworks of student integration theory and servant leadership theory, thus integrating the theoretical framework concepts into the analysis of this study's results. Finally, the study's results and theoretical framework guided the recommendations and implications for leadership.

Comparing Results to the Literature

The results of this study are somewhat consistent with previous research on the relationship between belongingness and persistence in engineering students. First-year Texas A&M EA students who developed belongingness showed associated persistence. This outcome

reinforces the theoretical framework and previous studies on belongingness and persistence for first-year college students (Geisinger & Raman, 2013; Scheidt et al., 2021; Tinto, 1975, 1993). In this study, the data analysis revealed that, for Texas A&M EA first-year students, (a) belongingness to the classroom and persistence had a positive correlation with a medium strength of association, (b) belongingness to the university as a community and persistence had a positive correlation with a weak strength of association, and (c) belongingness to the university as an institution (4-year institution) and persistence had a positive correlation with a strong strength of association. In particular, the Pearson product-moment correlation analysis can reveal variations of the strength of association, specified as weak, medium, and strong, defined as a quantitative measure of the linear association between the two variables (Gravetter et al., 2020; Laerd Statistics, 2022). Hence, associations identified as weak, medium, or strong indicate the likely outcome in predicting the average variations in EA students' persistence (Gravetter et al., 2020).

Moreover, this study's results agree with Gopalan and Brady (2020), who reported significant correlations between belongingness and persistence for college students, particularly belongingness to the classroom (Ahn & Davis, 2020), belongingness to the campus community (Johnson et al., 2020) and belongingness to the university (4-year institution; Pedler et al., 2022). Although the findings in this study show correlations with three different levels of strength association (weak, medium, and strong), previous research has confirmed a strong association between belongingness institution and persistence (Strayhorn, 2018; Zhang, 2021). In addition, some studies have found a medium association between belongingness to the classroom and persistence (Cooper & Fry, 2020; Moore, 2020).

In contrast, other researchers have not confirmed a weak association between

belongingness to the university as a community and persistence (Davis et al., 2019; Johnson et al., 2020; Wagle et al., 2021). For example, Johnson et al. (2020) found from a quantitative study ($N = 270$) of first-year engineering students that cohort programs focusing on place-based learning communities increased academic performance and fostered a strong association between belongingness to the campus community and persistence with an overall higher course passing rate. It should be noted that a weak association is still significant, although less influential, for predicting persistence from belongingness to the university as a community.

Other contradicting studies have found that grade-point average (GPA) can be the primary driver for persistence, disagreeing with the association between belongingness and persistence. For example, Zuckerman and Lo (2021) found that many community college students are extrinsically motivated, with a narrow focus on academic achievement, which can diminish their social integration in campus community activities. Hence, a narrow focus on academic achievement can lead to transactional behavior with a reduced focus on social integration, inhibiting belongingness development associated with persistence (Sotardi, 2022; Zuckerman & Lo, 2021).

The contradictory findings are not unexpected—Texas A&M EA students are enrolled in a college pathway program at a local community college outside the main campus and are thus in a transient environment. They often live at home and have family obligations, part-time jobs, and less chance of establishing new friendships with peers, unlike many students enrolled at the main campus at a 4-year institution, who often get involved with other students and activities on campus (Rucks-Ahidiana & Bork, 2020). Similar findings from the literature have shown that relationships exist between belongingness and persistence for on-campus college students, emphasizing the differences in adjustment experienced by commuter students compared to

resident students during the first year of college (Abdollahi et al., 2020).

Connecting Results to the Theoretical Framework

Serving students by helping them succeed by encouraging them to engage in activities that foster belongingness and persistence are consistent with the foundation of servant leadership theory and student integration theory used as the theoretical framework in this study (Greenleaf, 2002; Tinto, 1993). Further, this study confirms a significant correlation between three separate constructs of belongingness and persistence for college students, reinforcing the importance of Tinto's student integration theory in social integration and retention research (Tinto, 1993). Students sometimes doubt their belongingness and ability to succeed, leading them to feel like an imposter and forcing them to deal with challenges related to loneliness, lack of mattering, and stigma about attending community college. These factors contribute to a reduced social integration experience, thus weakening belongingness and increasing the risk of dropout (Shaw et al., 2019; Stein, 2020). In response, researchers have suggested supporting intervention activities based on servant leadership practices, thus alleviating student impediments by caring for their needs, which enhances social integration, belongingness, and persistence (Baumeister & Robson, 2021; Smith et al., 2021; Stein, 2020; Turner, 2022).

Out-of-classroom experiences, flipped classrooms, and project-based learning focusing on peer-group relationships, mattering, and belongingness developments are examples of supportive interventions. The outcome would likely be a stronger correlation between belongingness to the classroom, campus community, the institution, and persistence (Pedler et al., 2022). Because this study confirmed a significant correlation between three separate constructs of belongingness and persistence, the theories of student integration and servant leadership align in this study—they both posit that social integration (belongingness) and

alleviating student obstacles correlate with persistence in college (Shaw et al., 2019).

However, this study revealed a weak association between belongingness to the university as a community and persistence, suggesting that a change in servant leadership practices and intervention activities could increase the strength of association aligned with the theoretical framework (Crippen & Willows, 2019; Greenleaf, 2002; Strayhorn, 2018; Tinto, 1993). Hence, practices and activities to increase the strength of associations are included in the recommendations section. Further, because significant statistical correlations were found in this study for first-year Texas A&M EA students, the study extends Tinto's student integration theory for students in a co-enrolled pathway program.

Conclusions

This quantitative correlational study analyzed first-year Texas A&M EA students' persistence for continued enrollment in terms of their belongingness to the classroom, the university as a community, and the university (4-year institution). The data gathered and analyzed in the study provided conclusive evidence of statistically significant correlations between three constructs of belongingness and persistence. In the context of the theoretical framework, the findings from this research can be explained by the student integration theory, which suggests social integration (belongingness) leads to persistence. Likewise, servant leadership practiced by faculty and administration assists and facilitates student transitions during college, thus fostering belongingness.

In comparing the present study to other studies in the literature, the study confirms the finding of studies involving first-year college students, except for a weak association between belongingness to the university as a community and persistence. However, the present study does not confirm the results of Zuckerman and Lo (2021), who found that many community college

students are extrinsically motivated and narrowly focused on academic achievement. This narrow focus can lead to a lack of social integration, thus decreasing belongingness and persistence. This study adds to the research literature involving belongingness and persistence for continued enrollment of EA engineering students in a transitional pathway program.

Limitations

The research study was limited to a sample of first-year students enrolled in the Texas A&M University EA college pathway program. The sample comprised 155 first-year EA students enrolled in the fall semester of 2022. Restricting the study to a narrowly defined sampling frame of EA students limited the external validity of findings to other pathway programs. Similarly, focusing on remote location contexts could have limited the study. Therefore, in the context of Texas A&M University EA students, the generalizability of this study's findings to other first-year on-campus students is limited. Hence, threats to external validity could occur if readers apply conclusions to other students, contexts, and programs (Creswell & Guetterman, 2019).

Another limitation of this study stems from the cross-sectional study design, which collected data at one point in time, restricting the students' responses at the time of data collection and limiting the ability to capture variations in social integration affecting belongingness over time (Creswell & Guetterman, 2019; Tinto, 1993). In addition, the online survey method study limited data collection to participants' reports regarding the three constructs of belongingness and persistence. As a result, participants' self-reporting bias could have exaggerated the data obtained for the study. For example, although the threats to the reliability and validity of the survey scales for belongingness and persistence were discussed in Chapter 3, and the scales were found to be reliable and valid for this study, threats were possible.

Further, bias from self-reporting could have emerged because some groups of students were more represented in the sample than were others. In addition, motivation or mood at the time participants responded to the survey or a lack of randomization in the sample selection could have introduced limitations (Creswell & Guetterman, 2019). In sum, the results of this study are valid for first-year Texas A&M University EA students and cannot be assumed to apply to other universities' pathway programs or generalized to all Texas A&M first-year on-campus students.

Recommendations

The findings of this study suggest three lines of future inquiry that might enhance understanding of first-year engineering students' belongingness and persistence in co-enrolled college pathway programs. Researchers are encouraged to apply the suggestions in this section to guide future research. The following recommendations should contribute to advancing the scientific knowledge of first-year college students' belongingness and persistence in co-enrolled pathway programs. In addition, this section offers suggestions for leadership and instructional practices that might benefit EA retention, which is a concern for Texas A&M stakeholders and other universities with similar pathway programs.

Recommendations for Further Research

The first recommendation for further research is to determine if the level of confidence (M = 4.32; Table 1) found on the persistence survey correlates with actual persistence in transitioning to the second year for Texas A&M EA students. Hence, further research should be conducted to determine the correlation between the first-semester persistence committed for continued enrollment and actual retention. Second, the reliability coefficient Cronbach's alpha for the persistence survey in this study was .67 (Table 1), which was minimally acceptable

compared to values greater than .70 and .80, regarded as acceptable and good, respectively (Gravetter et al., 2020). In contrast, García-Ros et al. (2019) found a Cronbach's alpha of .78 in a study of first-year college students' retention. Therefore, in response to this discrepancy, further research examining the persistence instrument's Cronbach's alpha value for students in related EA pathway programs has merit.

The third suggestion for future research is to replicate this study at a different university with a similar co-enrollment program in partnership with local community colleges. Texas A&M is a large public university with a recognized engineering department and a well-established college pathway partnerships program with six local community colleges. These university characteristics could have influenced EA students' different strengths of associations (weak, medium, and strong) between the three constructs of belongingness and persistence. Therefore, replicating this research would advance the scientific knowledge regarding the strength of association and direction of a statistically significant correlation between the three constructs of belongingness and persistence for co-enrolled engineering students in university pathway programs.

Recommendations for Changes in Practices

The transition to college life is different for co-enrolled first-year Texas A&M EA students than for incoming on-campus students. EA students' assimilation into college life is less of a youthful college transition because they often live at home and have work and family responsibilities (Rucks-Ahidiana & Bork, 2020). Tinto (1993) acknowledged that a positive college transition is attained by separating from the familiar high school environment and emerging into the college community. Through stages, students are expected to embark on a journey of individualization, actively navigate the college environment, align with expected

behavior, and adapt to the college culture of institutional traditions, values, and expectations (Tinto, 2022). Hence, because rites of passage in and outside the college are less certain and more complex, first-year Texas A&M EA students often focus more on earning a college degree and less on establishing connections with peers and faculty or participating in college community activities (Di Martino et al., 2022; Sotardi, 2022).

Therefore, a practice recommendation is to provide preentry intervention programs, including early transition assistance and activities for EA students to help with integration and guide them through the college rites of passage phases while allowing for obligations outside the college. Preentry intervention programs can emphasize the importance of teamwork and encourage students to engage in activities in or outside the classroom, thus establishing peer relationships and mattering (Cole et al., 2020; Johnson et al., 2020). When students feel they matter, they develop a healthy self-concept necessary for social integration leading to relationships with peers and belongingness to the campus environment (Flett et al., 2021). Such programs can be based on project-based learning in a maker-space environment that focuses on establishing peer-group relationships, fostering cooperation, and building confidence among peers (Aksela & Haatainen, 2019; Martinez, 2022; Richterich & Zhang, 2022). Hence, preentry intervention programs can be significant for social integration and the development of belongingness, which is essential for persistence for first-year EA students (Tinto, 1993).

Transition assistance must be provided early in the first semester and continue throughout the first year while students move through college integration as a part of their rites of passage (Johnson et al., 2020). The transition assistance should include establishing trusting relationships with faculty, external mentors, administrators, and academic advisors focusing on social integration into the college environment. Finally, Texas A&M EA leaders should implement

servant leadership development programs for current and future community college partners, faculty, and administrators, focusing on activities that foster students' belongingness to the classroom and to the institution as a campus community.

Implications for Leadership

The findings of this study are noteworthy for leaders at Texas A&M EA and their community college partners because the study's results can influence leadership practices affecting the strength of the association between this study's three belongingness constructs and persistence for first-year EA students. Servant leadership was part of the theoretical framework of this study (Greenleaf, 2002). Servant leadership theory describes leaders who assist and emphasize ways of serving students so they can realize their potential academically and socially while pursuing their educational goals (Gultekin & Dougherty, 2021; Stein, 2020).

Hence, focusing on servant leadership practices, Texas A&M EA leadership should include a comprehensive professional development approach with community college partners that can foster collaboration and a deeper understanding of EA students' needs and barriers in the transition to college and progression through the first year (Crippen & Willows, 2019; Khatri et al., 2021; van Gennep, 1960). Further, implementing recommendations from this study could assist in building stronger associations between belongingness and persistence for EA students, thereby increasing first-year retention and aligning the retention rate with rates found at the main campus. Finally, a servant leadership approach could facilitate the Texas Higher Education Board's goal of having 60% of Texans aged 25 to 34 possess a degree or certificate from a 2- or 4-year institution (60x30TX plan, n.d.) and contribute to the overall engineering degree graduation rate in the U.S.

Conclusion

Increased demand for engineers in the U.S. led Texas A&M University to establish the Texas A&M Engineering Academies, a co-enrolled partnership program with six community colleges in Texas. The program allows students to co-enroll and reside outside the main campus of Texas A&M while being enrolled in Texas A&M courses taught by its faculty. The problem addressed in this study was a lack of knowledge about why Texas A&M EA students' first-year retention rates have been consistently about 10% lower than the rates for on-campus students. Following Tinto's (1993) theory of student integration, a lack of social integration might have impeded development of belongingness, a factor necessary to keep students from dropping out. The purpose of this quantitative correlational study was to examine the statistical relationships for three separate constructs of belongingness: (a) the classroom, (b) the university as a community, and (c) the university as an institution in relation to EA students' persistence.

The quantitative nonexperimental methodology included an online survey design, which collected perspectives of 155 first-year EA students over three weeks during the fall semester of 2022. The study's results revealed significant statistical relationships with positive directions with various strengths of the correlations. For belongingness to the classroom and persistence, a positive correlation showed a medium strength of association; for belongingness to the university as a community and persistence, a positive correlation was found with a weak strength of association; and for belongingness to the university (4-year institution) and persistence, a positive correlation showed a strong strength of association. Thus, although statistically significant correlations were determined, this study suggests differences existed in the strengths of the three constructs of belongingness (weak, medium, and strong) with persistence.

The findings of significant correlations were mostly consistent with other studies

discussed in the literature review; however, weak associations to date have not been reported. The study was limited to first-year EA students; therefore, generalization is restricted to the Texas A&M EA program. In sum, the results of this study expand on the knowledge of belongingness and intention to persist for first-year engineering students co-enrolled in a 4-year pathway program.

Future research should be conducted to determine the correlation between the first-semester persistence committed for continued enrollment and actual retention. Second, researchers should examine the persistence instrument's Cronbach's alpha value for students in related EA pathway programs, found to be minimally acceptable in this study. The final recommendation for future research is to replicate this research to verify the strength and directions of the associations in similar pathway programs.

This study's recommendations for practices could increase first-year EA students' persistence toward continued enrollment by establishing preentry intervention programs that foster peer relationships and engagement in the institutional community, thereby strengthening the correlation between belongingness in the classroom and community to persistence. In creating preentry intervention programs, Texas A&M EA leaders should focus on project-based learning in a maker-space environment that focuses on peer-group relationship and fosters mattering. In addition, based on servant leadership practices, transition assistance to support EA students through phases of rates of passage should be an ongoing process focusing on social integration and lessening obstacles students experience in their transition phase.

The significance of this study mainly stems from the different strength associations found from the data analysis, specifically, the medium strength association found between belongingness to the classroom and persistence and the weak strength association found between

belongingness to the university as a community and persistence. This variation in strength might be related to a focus on co-enrollment status of EA belongingness to the university as a 4-year institution with a strong association rather than on the social integration at community college partner locations outside the main campus. Therefore, the recommendation is to provide preentry programs and transition assistance that establish peer relationships and perceptions of mattering among students. Finally, whether a first-year student enters Texas A&M University through the Engineering Academies program or direct entry at the main campus, the study's findings, recommendations, and implications for leadership could positively influence the associations between belongingness and persistence for EA students and decisions to persist through obstacles as well as promote mental health, thus improved retention toward obtaining a 4-year engineering degree from Texas A&M irrespective of their first-year entry.

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Appendix A:

IRB Approval

AMERICAN COLLEGE of EDUCATION

May 25, 2022

To : [redacted]

From : [redacted]

Re: IRB Approval

"A Correlation Study of Belongingness and Persistence in Engineering Academies Students"

The American College of Education IRB has reviewed your application, proposal, and any related materials. We have determined that your research provides sufficient protection of human subjects.

Your research is therefore approved to proceed. The expiration date for this IRB approval is one year from the date of review completion, May 25, 2023. If you would like to continue your research beyond this point, including data collection and/or analysis of private data, you must submit a renewal request to the IRB.

Candidates are prohibited from collecting data or interacting with participants if they are not actively enrolled in a dissertation sequence course (RES6521, RES6531, RES6541, RES6551, RES6561, RES6302) and under the supervision of their dissertation chair.

Our best to you as you continue your studies.

Sincerely,

[redacted]

DIVISION OF RESEARCH

TEXAS A&M UNIVERSITY

HUMAN RESEARCH, NOT ENGAGED DETERMINATION

6/6/2022

Type of Review:	External Investigator Project
Study Title:	A Correlation Study of Belongingness and Persistence in Engineering Academies Students
Investigator:	Sue Adragna and Bjorn Bangstein
Investigator's Institution:	American College of Education (ACE)
Funding:	N/A
Documents Received:	ACE IRB Checklist (2).pdf Permission Letter - Brief Index of Student... Permission Letter - Measures of Belongin... RES 6521 M4 Dissertation Checklist - Ban... RES 6521 M5 Informed consent.docx RES 6521 M5 Instruments.docx RES 6521 M5 Recruitement Email.docx CITI Completion Report Bangstein.pdf Email_ Pre-IRB site permission request fo... Email1_Doctoral research proposal with e... Human Research Not Engaged TAMU.doc IRB_Approval.pdf Research proposal RES 6541 M4 Chapter ...

To Whom It May Concern,

This Institution has determined that the proposed activity is research involving human subjects as defined by DHHS regulations but that this organization is not engaged in the research. Therefore, additional IRB review and approval by the TAMU IRB is not required.

This determination is not an IRB approval or endorsement of this research. This determination applies only to the activities described in the documents provided by the Investigator and does not apply should any changes be made that create questions as to whether Texas A&M University faculty, staff or students are engaged in the research. If such protocol changes are made, please submit a new request for a new determination.

This determination letter may be forwarded to the appropriate division officials. This letter does not provide access to any TAMU group that you have not already gained permission to contact. Also, there is no guarantee of participation as individuals (e.g. Deans, Department Heads, faculty, staff, students, etc...) may choose not to participate in the study independently of this determination.

If you have any questions, please contact the HRPP Administrative Office [redacted]

Sincerely,

[redacted]

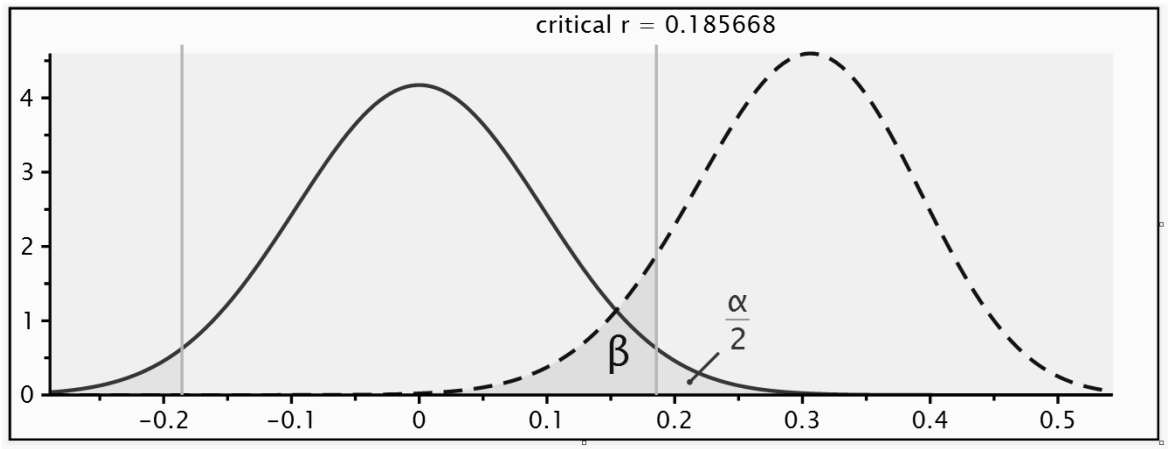
[redacted]

Version date: 04/08/2021

Appendix B:

Target Sample Size

*G*Power for Sample Size Estimation for Correlational Analyses*



[1] -- *Sunday, February 20, 2022 -- 13:07:35*
Exact - Correlation: Bivariate normal model

Options:	exact distribution		
Analysis:	A priori: Compute required sample size		
Input:	Tail(s)	=	Two
	Correlation ρ H1	=	0.3
	α err prob	=	0.05
	Power (1-β err prob)	=	.9
	Correlation ρ H0	=	0
Output:	Lower critical r	=	-0.1856685
	Upper critical r	=	0.1856685
	Total sample size	=	112
	Actual power	=	0.9008078

Appendix C:

Permission to Use Instruments

1/20/22, 5:10 PM Mail - Bjorn-Harald Bangstein - Outlook

Re: Request to us a instrument from ASEE paper in educational research

Bjorn-Harald Bangstein [redacted]
Thu 1/20/2022 5:07 PM
To: [redacted]
Cc: [redacted]
Hi [redacted]
Thank you so much for allowing me to use the instruments listed in Table 1. The paper and instruments will be fully cited in the dissertation using the latest APA format.
Br,
Bjorn

From: [redacted]
Sent: Thursday, January 20, 2022 4:55 PM
To: Bjorn-Harald Bangstein [redacted]
Cc: [redacted]
Subject: RE: Request to us a instrument from ASEE paper in educational research

Please be cautious
This email originated from outside of ACE organization

Hi Bjorn,

Thanks for your inquiry. You're welcome to use the table provided you include a citation stating that it is from a paper presented at ASEE's 2012 Annual Conference in San Antonio, Texas, and include the paper's title.

Sincerely,

[redacted]

American Society for Engineering Education
Inspiring Innovation. Advancing Research. Enhancing Education.
[redacted]

https://outlook.office.com/mail/inbox/id/AAQkADYyNTBmYWE4LWYwMjktNGJhYS05OWIzLWVlOTY1MTQ0ZjM0YQAQAFQ3frkItzxHg1IVsD43cBc%3D 1/2

1/20/22, 5:10 PM Mail - Bjorn-Harald Bangstein - Outlook

From: Bjorn-Harald Bangstein [redacted]
Sent: Thursday, January 20, 2022 12:38 PM
To: [redacted]
Subject: Request to us a instrument from ASEE paper in educational research

Dear [redacted]

My name is Bjorn Harald Bangstein, and I am a doctoral candidate at the American College of Education (ACE) in Educational Leadership focusing on STEM writing to request permission to use the Measures of Belonging in Higher Education instruments (Table 1) from the paper Investigation of Belonging for Engineering and Science Undergraduates by Year in School presented at the 2012 ASEE Annual Conference & Exposition (link below).This information will be used for my dissertation research: A Correlation Study of Belongingness and Persistence in Engineering Academies Students. The purpose of the quantitative study will be to examine the statistical relationship between the three separate constructs of belongingness: (a) the classroom, (b) university as a community, and (c) university as an institution on the engineering academies student's persistence.

[redacted]

Would you be so kind as to please allow me to use the Measures of Belonging in Higher Education instruments (Table 1) as surveys for this study?

Best regards,
Bjorn

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Re: [External] Request to use: The College Persistence Questionnaire

Bjorn-Harald Bangstein [redacted]
Mon 1/17/2022 8:36 AM
To: [redacted]
Great, thank you so much Dr [redacted]
I will send you a summary of the findings, when finished,
Br,
Bjorn

From: [redacted]
Sent: Monday, January 17, 2022 8:14 AM
To: Bjorn-Harald Bangstein [redacted]
Subject: Re: [External] Request to use: The College Persistence Questionnaire

Please be cautious
This email originated from outside of ACE organization

Dear Sir,
You have permission to use the CPQ for your dissertation research. Your topic sounds interesting and I would greatly appreciate a summary of your findings when you finish your study.

Sincerely,
[redacted]

On Mon, Jan 17, 2022 at 5:45 AM Bjorn-Harald Bangstein [redacted] wrote:

> Dear Dr. [redacted]
> My name is Bjorn Harald Bangstein, and I am a doctoral candidate at the American College of Education (ACE) in Educational Leadership focusing on STEM writing to request permission to use The College Persistence Questionnaire: Development and validation of an instrument that predicts student attrition (2009). This information will be used for my dissertation research: A Correlation Study of Belongingness and Persistence in Engineering Academies Students. The purpose of the quantitative study will be to examine the statistical relationship between the three separate constructs of belongingness: (a) the classroom, (b) university as a community, and (c) university as an institution on the engineering academies student's persistence.
>
> Would you be so kind as to please allow me to use your College Persistence Questionnaire as surveys for this study?
>
> Best regards,
> Bjorn
>
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		Start Page	381
Article Title	Collegiate psychological sense of community in relation to size of college/university and extroversion	End Page	394
		Issue	4
		Volume	24
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NEW WORK DETAILS

Title	A Correlation Study of Belongingness and Persistence in Engineering Academies Students	Institution name	American College of Education (ACE)
		Expected presentation date	2023-03-01
Instructor name	Bjorn Harald Bangstein		

ADDITIONAL DETAILS

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The requesting person / organization to appear on the license	Bjorn Harald Bangstein

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Editor of portion(s)	Lounsbury, John W.; DeNeui, Daniel		
Volume of serial or monograph	24	Author of portion(s)	Lounsbury, John W.; DeNeui, Daniel
Page or page range of portion	381-394	Publication date of portion	1996-01-01

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SAGE Publishing

Factorial and Criterion Validity of Scores of a Measure of Belonging in Youth Development Programs

Author: Dawn Anderson-Butcher, David E. Conroy
Publication: Educational and Psychological Measurement
Publisher: SAGE Publications
Date: 10/01/2002

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Appendix D:

Recruitment Email

Date: September 23, 2022

Dear Texas A&M Engineering Academies Student,

I am a doctoral student at the American College of Education. I am writing to let you know about an opportunity to contribute to original research by answering a short web-based survey. This research, titled, A Correlation Study of Belongingness and Persistence in Engineering Academies Students, was approved by the American College of Education Institutional Review Board (IRB) and accepted by Texas A&M University IRB. While motivational factors have been shown to support first-year students' persistence to continue enrollment, less is known about the relationship between belongingness and persistence for engineering academies students.

The benefit of the study is to examine if there is a correlation between belongingness and persistence. As a result of this study, Texas A&M engineering academies leadership may find it valuable to develop programs or activities to support or promote belongingness or a sense of belonging. The result could increase persistence and therefore support continued enrollment and graduation.

If you agree to participate in the study, please select the link provided in this email. You will enter a web based SurveyMonkey survey after answering the question about willingness to participate, the consent. Participation is entirely voluntary, and you can leave at any time.

I may publish the results of this study; however, I will not use your name or location in the study. Your information will remain confidential. At the end of the study, the result will be available for the participants. If you would like additional information about the study before, during, or after the survey, please call me at [redacted] or email me at: [redacted]

Link to approved IRB, informed consent: [redacted]

Thank you again for considering this dissertation research opportunity.

Bjorn Harald Bangstein

Appendix E:

Informed Consent

A Correlation Study of Belongingness and Persistence in Engineering Academies Students

Informed Consent

Informed Consent

Prospective Research Participant: Read this consent form carefully and ask as many questions as you like before deciding whether you want to participate in this research study. You are free to ask questions at any time before, during, or after you participated in this research.

Project Information

Project Title: A Correlation Study of Belongingness and Persistence in Engineering Academies Students

Researcher: Bjorn Harald Bangstein
Organization: American College of Education
Email: [redacted]
Telephone: [redacted]

Date of IRB Approval:
Please note that this research study has been approved by the American College of Education Institutional Review Board. The IRB approved this study on May 25, 2022. A copy of the approval letter will be provided upon request.

Researcher's Faculty Member: Dr. [redacted]
Organization and Position: American College of Education, Dissertation chair
Email: [redacted]

Introduction
I am Bjorn Harald Bangstein, a doctoral candidate student at the American College of Education. I am researching under the guidance and supervision of my Chair, Dr. [redacted] I will give you some information about the study and invite you to be part of this research. Before you decide, you can talk to anyone you feel comfortable with about the research. This consent form may contain words you do not understand. Please ask me to stop as we go through the information, and I will explain. If you have questions later, you can ask them then.

Purpose of the Research
The purpose of this quantitative correlational study is to examine the statistical relationship between the three separate constructs of belongingness: (a) the classroom, (b) university as a community, and (c) university as an institution on the engineering academies student's persistence. You are being asked to participate in a research study that will assist with understanding the relationship between belongingness and persistence. Through the investigation, the determination of the relationship between belongingness and persistence for engineering academies students could inform and support the engineering academies administration response to promote belongingness and persistence for continued enrollment and graduation.

Research Design and Procedures
The study will use a quantitative correlation methodology research design. Surveys will be submitted to engineering academies students located at San Antonio, Austin, Blinn, Dallas, and Midland partner institutions. The study will comprise a total population sampling method of approximately 350 participants who will be invited to an online survey.

Participant selection
You are being invited to participate in this research because you are an engineering academies first-year student and because you can contribute much to the study on belongingness and persistence for continued enrollment and graduation. Participant selection criteria: first-year Texas A&M engineering academies students.

Voluntary Participation
Your participation in this research is entirely voluntary. It is your choice whether to participate. If you choose not to participate, there will be no punitive repercussions.

Right to Refuse or Withdraw
Participation is voluntary. At any time, you wish to end your participation in the research study, you may do so by sending me an email explaining you are opting out of the study. There will be no repercussions for leaving the study.

Procedures

* 1. **Certificate of Consent**
I have read the information about this study, or it has been read to me. I acknowledge why I have been asked to be a participant in the research study. I have been provided the opportunity to ask questions about the study, and any questions have been answered to my satisfaction. By clicking on the "yes" button, I will advance to the next portion of the electronic survey and acknowledge I am at least 18 years of age. When I click on the "I consent" button, I consent voluntarily to participate in this study, at which time the survey will automatically record the date and hide my email address for my participation.

PLEASE KEEP THIS INFORMED CONSENT FORM FOR YOUR RECORDS.

This survey will be open for three weeks from September 23, 2022. Data gathering will progress for three weeks, and then the analysis will proceed with whatever number of respondents have agreed to participate. Additionally, reminder email will be sent.

If you are interested in participating in the research, please make your selection below:

- ◯ I consent, begin the survey
- ◯ I do not consent, I do not wish to participate (exit the survey)

Next

Powered by
SurveyMonkey
See how easy it is to create a survey.

Appendix F:

Instruments

A Correlation Study of Belongingness and Persistence in Engineering Academies Students

College Persistence Questionnaire (CPQ)

2. Please select one answer for each for each question below using the scale: Strongly agree (5), Somewhat agree (4), Neither agree nor disagree (3), Somewhat disagree (2), Strongly disagree (1).

	Strongly agree (5)	Somewhat agree (4)	Neither agree nor disagree (3)	Somewhat disagree (2)	Strongly disagree (1)
a. How likely is it that you will earn a degree from here?	○	○	○	○	○
b. How confident are you that this is the right university for you?	○	○	○	○	○
c. How likely is it that you will reenroll here next semester?	○	○	○	○	○
d. How much thought have you given to stopping your education here, perhaps transferring to another college, going to work, or leaving for other reasons?	○	○	○	○	○

Prev Next

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A Correlation Study of Belongingness and Persistence in Engineering Academies Students

Measures of Belonging: To Class

3. Please select one answer for each for each question below using the scale: Strongly agree (5), Somewhat agree (4), Neither agree nor disagree (3), Somewhat disagree (2), Strongly disagree (1).

	Strongly agree (5)	Somewhat agree (4)	Neither agree nor disagree (3)	Somewhat disagree (2)	Strongly disagree (1)
a. I feel accepted in this class.	○	○	○	○	○
b. I feel comfortable in this class.	○	○	○	○	○
c. I feel supported in this class.	○	○	○	○	○
d. I feel that I am a part of this class.	○	○	○	○	○

Prev Next

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A Correlation Study of Belongingness and Persistence in Engineering Academies Students

Measures of Belonging: To University as Community

5. Please select one answer for each for each question below using the scale: Strongly agree (5), Somewhat agree (4), Neither agree nor disagree (3), Somewhat disagree (2), Strongly disagree (1).

	Strongly agree (5)	Somewhat agree (4)	Neither agree nor disagree (3)	Somewhat disagree (2)	Strongly disagree (1)
a. People at this school are friendly to me	○	○	○	○	○
b. I feel that there is a real sense of community at this school.	○	○	○	○	○
c. I feel like there is a strong feeling of togetherness on campus.	○	○	○	○	○

Prev Next

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A Correlation Study of Belongingness and Persistence in Engineering Academies Students

Measures of Belonging: To University as Institution

4. Please select one answer for each for each question below using the scale: Strongly agree (5), Somewhat agree (4), Neither agree nor disagree (3), Somewhat disagree (2), Strongly disagree (1).

	Strongly agree (5)	Somewhat agree (4)	Neither agree nor disagree (3)	Somewhat disagree (2)	Strongly disagree (1)
a. I feel like I really belong at this school.	○	○	○	○	○
b. I really enjoy going to school here.	○	○	○	○	○
c. I wish I had gone to another school instead of this one.	○	○	○	○	○
d. I wish I were at a different school.	○	○	○	○	○

Prev Next

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See how easy it is to create a survey.

A Correlation Study of Belongingness and Persistence in Engineering Academies Students

Thank You

Thank you for taking the time to participate in this survey.

Prev Done

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See how easy it is to create a survey.

Appendix G:

Research Site Acceptance

11/2/22, 6:43 AM Mail - Bjorn-Harald Bangstein - Outlook

RE: Doctoral dissertation research at Texas A&M engineering academies

[redacted]

To: Bjorn-Harald Bangstein [redacted]

Please be cautious

This email originated from outside of ACE organization

Dear Bjorn Harald Bangstein,

We confirm that invitation emails to attend your study were sent out to 322 students from the office of academic advisors that align with the IRB-approved participant criteria of being a Texas A&M University Engineering Academies first-year student.

[redacted]

Hello Bjorn,

Thanks for collec ng this informa on and for this study. Have a good week!

[redacted]

From: Bjorn-Harald Bangstein [redacted]
Sent: Monday, October 3, 2022 6:19 AM
To: [redacted]
Subject: Doctoral dissertation research at Texas A&M engineering academies

Hi Dr. [redacted]

I hope you are doing well. Thank you very much for allowing my doctoral dissertation research, "A Correlation Study of Belongingness and Persistence in Engineering Academies Students," to progress by agreeing to distribute the IRB-approved survey to the 322 first-year students at Texas A&M University engineering academies. I am looking forward to presenting the finding upon completing the dissertation.

Br,

Bjorn Bangstein

ACE Doctoral Candidate

https://outlook.office.com/mail/inbox/id/AAQkADYyNTBmYWE4LWYwMjktNGJhYS05OWIzLWVlOTY1MTQ0ZjM0YQAQADCqCxCKQKxDt0IpO1QhH5... 1/1