INVESTIGATING THE FACTORS IMPACTING HISPANIC STUDENTS' RETENTION IN HIGHER-EDUCATION CONSTRUCTION PROGRAMS

A Dissertation

by

MOHAMMADREZA OSTADALIMAKHMALBAF

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Chair of Committee,	Stephen Caffey
Co-Chair of Committee,	Manish Dixit
Committee Members,	Edelmiro Escamilla
	Manuel Piña, Jr.
Head of Department,	Robert Warden

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ABSTRACT

Hispanic workers play a central role in the United States (US) construction industry, but they still lag behind other population groups in obtaining bachelor's degrees. To grow the number of Hispanic construction managers, there should first be a growth in Hispanics earning construction science degrees. Construction education has a problem retaining Hispanic students since many of them who begin postsecondary education simply do not graduate. The purpose of this study was first to identify the factors contributing to the retention of Hispanic students in construction science education programs and then to explore the factors with the strongest positive effect.

A mixed methods research synthesis (MMRS) was employed to analyze a body of empirical articles reporting on the factors impacting Hispanic student retention in construction education. The literature revealed different factors including financial aid, construction-related student organizations, tutorial services, academic advising, career development programs, academic workshops, construction-oriented learning communities, undergraduate research experience, extracurricular activities, mentoring programs, Hispanic faculty members in the construction program, and Hispanic peers and students in the construction program.

To determine on which factors undergraduate construction programs should focus retention strategies to enhance Hispanic student success, this study employed the Delphi method on two levels:

- Academic level (experiment group)
- Construction industry level (control group)

The results of the experiment group demonstrated that financial aid, academic advising, and mentoring programs were the top three most important factors among all these three groups. In addition, the results of the control group showed that Hispanic industry professionals perceived financial aid, career development programs, and tutorial services as the top three most important retention factors. While mentoring programs were reported as the most important factor by the literature, this factor was ranked as the least important by industry professionals in round two, revealing the limited knowledge of industry professionals on the impact of mentoring. This limited knowledge can be attributed to the lack of representation of mentoring programs in construction education programs in Texas.

Finally**,** the study proposed the HACS (Hispanic Aggies in Construction Science) Program as an initiative for increasing the retention of Hispanic students in higher education construction programs.

DEDICATION

This dissertation is dedicated to Hazrat Aba Abdillah Al-Hossein, who manifested the highest of every human behavior. Oh Hossein! My love for you is beyond measure. Peace be upon you, your brother and all your companions as long as I live and as long as there is day and night till the Day of resurrection.

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CONTRIBUTORS AND FUNDING SOURCES

Contributors

This work was supervised by a dissertation committee consisting of Professor Stephen Caffey (chair) of the Department of Architecture, Professor Edelmiro Escamilla (advisor) and Professor Manish Dixit (co-chair) of the Department of Construction Science, and Professor Manuel Pina of the Department of Agriculture.

All other work conducted for the dissertation was completed by the student independently.

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NOMENCLATURE

ASC Associated School of Construction

BLS Bureau of Labor Statistics

CPWR Center for Construction Research and Training

IRB Institutional Review Board

MMRS Mixed Methods Research Synthesis

NAHB National Association of Home Builders

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CHAPTER I

INTRODUCTION

Hispanic workers play a central role in the United States (US) construction industry and have a substantial impact on US construction activities. As of 2017, Hispanic workers constitute 29.8% (almost 3.2 million) of the US construction industry workforce—the largest percentage of any ethnic group in the construction industry (Bureau of Labor Statistics [BLS], 2017) (Figure 1).

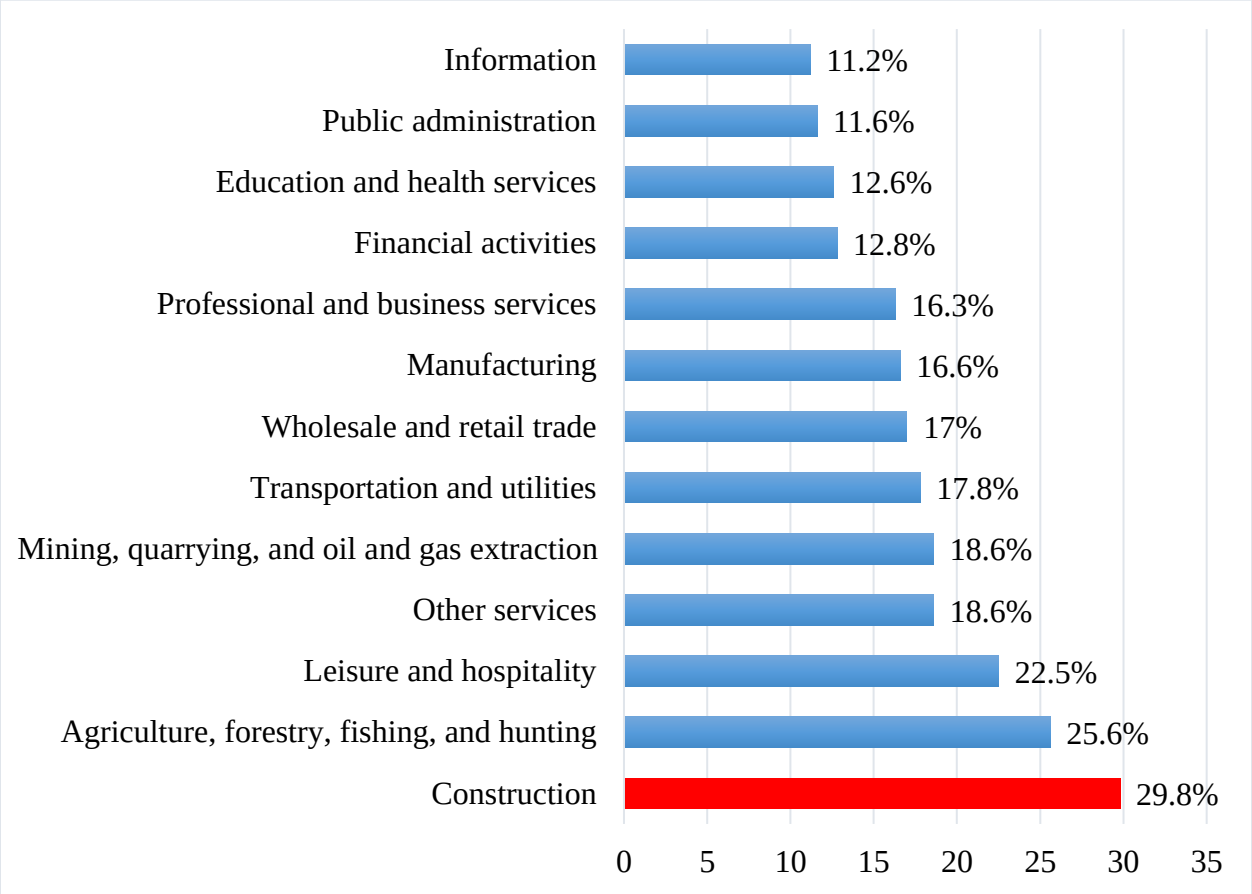

Figure 1. Percentage of Industry Employment That Is of Hispanic or Latino Ethnicity, 2017 Annual Averages

But they still lag behind other population groups in obtaining bachelor's degrees (Figure 2): only 6.9% of Hispanics in the construction industry have a bachelor's degree or higher, and 46% of them have less than a high-school diploma (Center for Construction Research and Training [CPWR] Data Center, 2018).

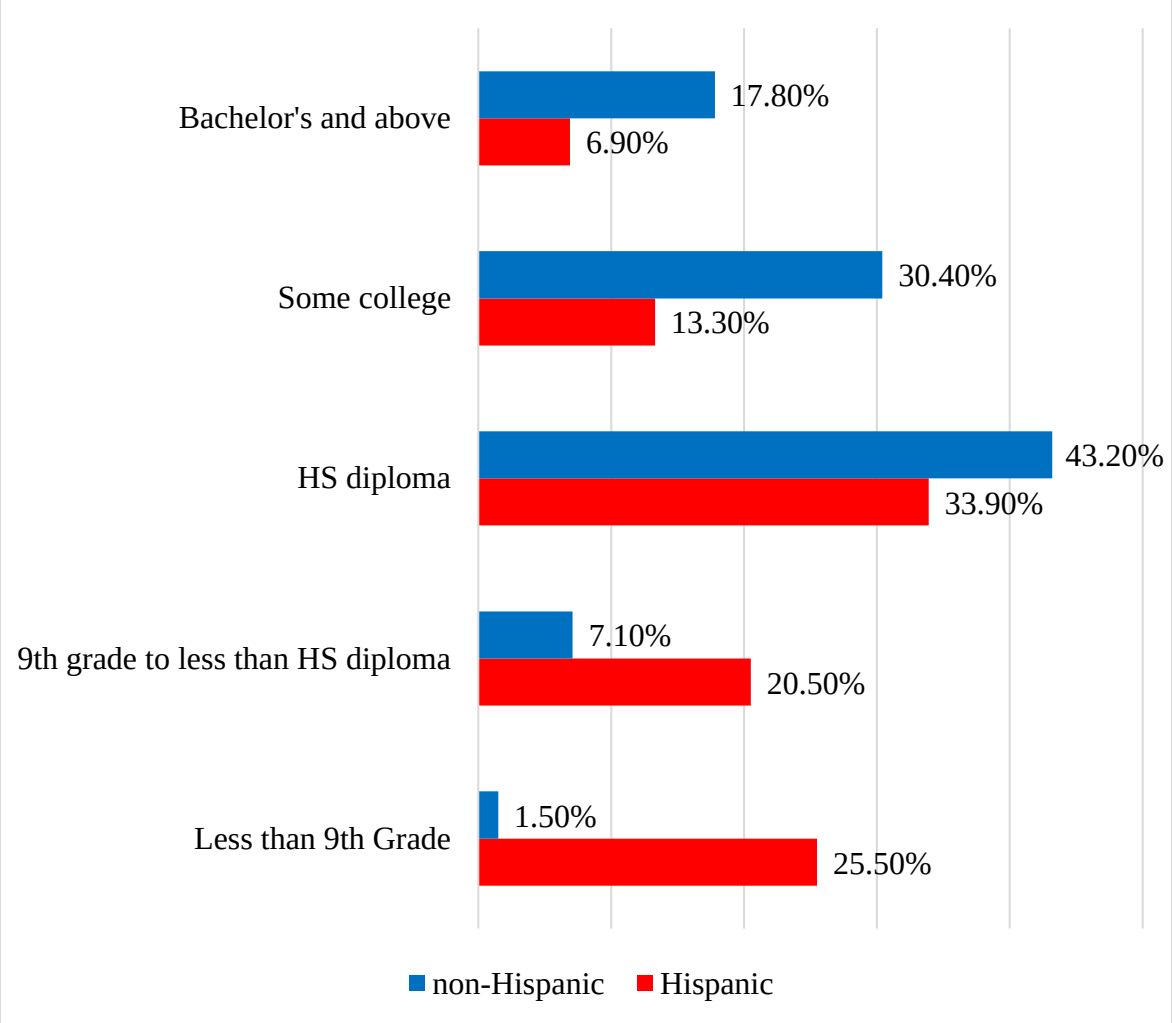

Figure 2. Distribution of Educational Attainment among Construction Workers, 2015 (All Employment)

While Hispanics account for more than 45.5% of construction laborers, only about 11% of construction managers are Hispanic (BLS, 2016b), which can be attributed to the fact that they are underrepresented in management positions in construction careers.

Call for Hispanic Construction Managers

While effective communication is critical for the successful implementation of any construction project (Escamilla et al., 2018, Pariafsai, 2016), it is a major problem in construction occupations. A study of 97 Hispanic construction craft workers on heavy/highway and commercial projects in Iowa reported that 55% of workers identify a lack of communication as the main obstacle on the job site (Canales et al., 2009). In addition, Dong et al. (2013), by analyzing nationally representative data from the 2008 Survey of Income and Program Participation, found that "more than 80% of Hispanic construction workers did not speak English at home and 37% of Hispanic construction workers did not speak English very well or did not speak English at all." As of 2015, according to CPWR (The Center for Construction Research and Training) (2018), about 30% of construction workers speak a language other than English at home (nearly 86% of foreign-born construction workers report speaking Spanish at home). Failure to communicate effectively decreases the safety and productivity of construction workers (Escamilla et al., 2017)

Understanding cultural differences is just as crucial as communication (National Association of Home Builders [NAHB] Now, 2015). Hofstede (1991) defined culture as "the collective programming of the mind, which distinguishes the members of one group or category of people from another" (p. 5). Brunette (2004) stated that once Hispanic workers immigrate to the US, they "bring with them varied histories, cultural sensibilities, strong health beliefs, and a different cultural background in comparison with non-Hispanic workers" (p. 246). Mismanaging

cultural diversity can result in lower morale, lower productivity, and higher accident rates (Loosemore & Lee 2002). In order to overcome language and cultural barriers, there is a call for bilingual and bicultural construction managers for foreman and supervisory roles in the construction industry.

Problem Statement

In an effort to grow the number of Hispanic construction managers in the U.S. market, there should first be a growth in Hispanics earning construction science degrees (Escamilla et al., 2016, Escamilla & Ostadalimakhmalbaf, 2016). Many Hispanic students who begin postsecondary education simply do not graduate, and their college completion rate remains low (Lumina Foundation, 2011; Pyne & Means, 2013). The problem of this research is that construction education in particular has a problem retaining Hispanic students who could be the future professionals meeting this challenge (Escamilla et al., 2018, Bigelow et al., 2016).

As can be seen in Table 1, by looking a cohort of students during 2008 to 2014, 2009 to 2015, and 2010 to 2016, the retention and graduation rates of Hispanics in the Department of Construction Science at Texas A&M University are comparatively lower than all students (and particularly White students) in the department, as well as in the College of Architecture and university-wide. As a matter of fact, about 63% of Hispanic students left the Department of Construction Science during 2009 to 2015 and 2010 to 2016. While the main reasons for the low retention rate of Hispanic students should be investigated, this research focuses instead on what retention strategies are most influential to assist construction science programs in enhancing Hispanic student success. Research in the area of Hispanics in construction education is limited. This study can serve as a basis for future research in Hispanic student retention.

Table 1. Retention and Graduation Rates of Students in Construction Science at Texas A&M University, By Race and Ethnicity (Data and Research Services [DARS], 2018)

		Fall Cohort	Headcount	% 1-yr Retained	% 4-yr Graduated	% 5-yr Graduated	% 6-yr Graduated
Department of Construction Science	**All Students**	2008	72	70.80%	30.60%	61.10%	61.10%
		2009	57	66.70%	35.10%	59.60%	59.60%
		2010	44	72.70%	38.60%	54.50%	54.50%
	Hispanic Students	2008	17	47.10%	11.80%	47.10%	47.10%
		2009	12	**41.70%**	8.30%	33.30%	**33.30%**
		2010	9	66.70%	11.10%	33.30%	**33.30%**
	White Students	2008	51	78.40%	39.20%	66.70%	66.70%
		2009	40	72.50%	42.50%	67.50%	67.50%
		2010	35	74.30%	45.70%	60.00%	60.00%
College of Architecture	**All Students**	2008	200	94.00%	50.00%	83.50%	87.00%
		2009	202	90.60%	55.40%	74.80%	77.20%
		2010	195	92.80%	61.50%	83.10%	85.60%
	Hispanic Students	2008	53	90.60%	37.70%	77.40%	81.10%
		2009	51	82.40%	45.10%	60.80%	64.70%
		2010	48	83.30%	41.70%	70.80%	75.00%
	White Students	2008	138	94.90%	55.10%	85.50%	89.10%
		2009	139	94.20%	59.00%	80.60%	82.00%
		2010	135	96.30%	70.40%	88.10%	89.60%
University-Wide	**All Students**	2008	8093	92.00%	50.20%	76.40%	80.10%
		2009	8071	90.80%	51.20%	76.60%	79.90%
		2010	8175	91.40%	52.30%	77.70%	80.80%
	Hispanic Students	2008	1315	89.20%	45.20%	68.20%	73.20%
		2009	1393	87.20%	41.80%	67.80%	72.00%
		2010	1502	88.20%	44.00%	68.80%	73.10%
	White Students	2008	5918	92.50%	52.90%	78.90%	82.10%
		2009	5758	92.10%	53.90%	79.50%	82.50%
		2010	5666	92.30%	55.30%	80.70%	83.50%

Background: Immigrant Construction Workers

The Hispanic workforce in construction is internally diverse. As of 2015, there are more than 2.8 million Hispanic construction workers, and 73% of them were born outside the US (nearly

74% of foreign-born construction workers are not US citizens) (CPWR, 2018). The majority of foreign-born workers in construction (84.3%) were born in Latin-American countries, with Mexico accounting for 53.1% of foreign-born workers, followed by El Salvador (6.6%), Guatemala (5.4%), Honduras (4.7%), and a small percentage from other countries in that area (CPWR, 2018). According to the NAHB (2015), many of the most in-demand positions, such as such as carpenters, laborers, painters, roofers, brick masons, and drywall/ceiling tile installers, are filled by immigrants (Theodore et al., 2017; Valdez, 2018).

Immigrants are critical to Texas construction activities in particular. According to census data (2016), the state ranks second in the nation, with 41.8% foreign-born construction workers (Cox & Alm, 2018). The number of Mexican construction workers in Texas is more than any other state, accounting for 33% (Figure 3) of the state's construction workers in 2016 (Cox & Alm, 2018).

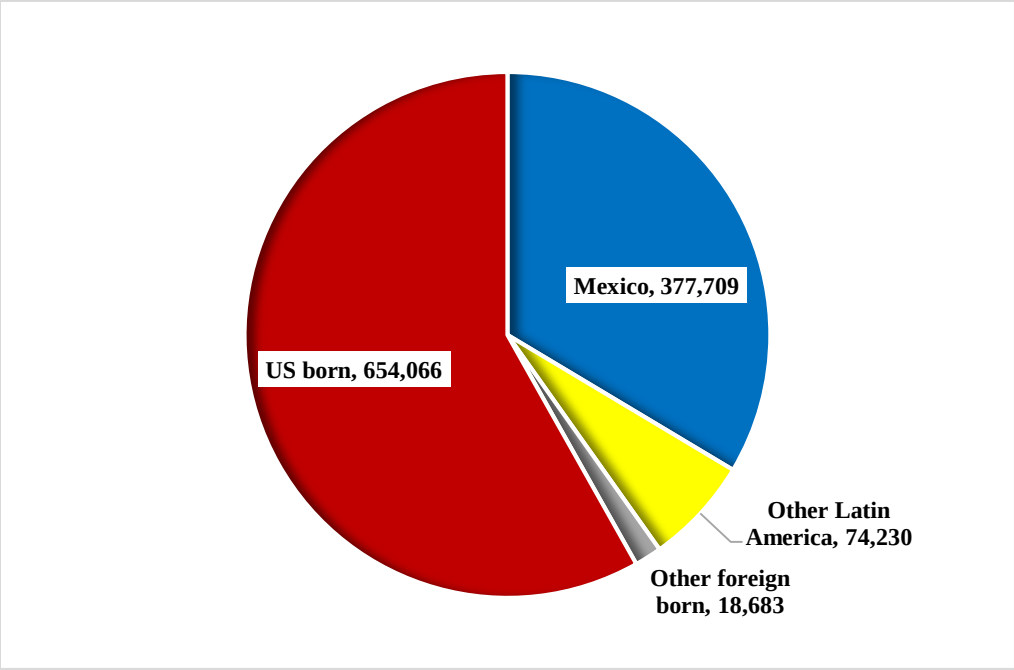

Figure 3. Immigrant Construction Workers in Texas

Purpose of the Study

The purpose of this study was to identify the factors contributing to the retention of Hispanic students in construction science education and then to explore which of those factors has the strongest positive effect on Hispanic students in construction science education programs. In other words, this study critically investigated the impact of retention factors on Hispanic students in their construction science education. Specifically, this study investigated the following questions:

1) What is known about the factors helping to retain Hispanic students in construction science education programs?
2) Which factors are most influential in increasing Hispanic student retention in construction science education programs?

Significance of the Study

This study is significant to the higher education construction programs because its findings provide empirical evidence on the degree of influence that identified factors have on improving Hispanic student retention in construction science education. Changes based on this research should work to decrease the attrition rate of Hispanic students in the construction education programs.

Definitions

1) *Hispanic* and *Latino*: In this study, the terms Hispanic and Latino are used interchangeably. According to the US Office of Management and Budget (OMB), Hispanic or Latino refers

to “a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin, regardless of race. The term ‘Spanish origin’ can be used in addition to Hispanic or Latino” (US Department of Labor 2011).

2) *Retention:* According to the National Center for Education Statistics (NCES) (2015), student retention refers to students who persist in and graduate from their programs.
3) *Mentoring:* Mentoring is a relationship in which an experienced individual provides task-coaching, emotional encouragement, information, feedback, availability, and acceptance to a less-experienced individual (Northouse, 2011).
4) *Construction Manager:* Construction managers plan, coordinate, budget, and supervise construction projects from start to finish (CPWR, 2018, p. 66).
5) *Foreign-Born:* Being foreign-born “refers to individuals who reside in the U.S., but were born outside the country or one of its outlying areas and to parents who were not U.S. citizens, including legally admitted immigrants, refugees, temporary residents such as students and temporary workers, and unauthorized (or undocumented) immigrants” (CPWR, 2018, p. 68).
6) *Cohort*: “A cohort is a group of students who follow the same class schedule and progress together through an accelerated program until degree attainment. The unique scheduling, along with small class sizes, promotes an interactive learning environment, facilitates networking opportunities, strengthens student relationships, and enhances the student learning experience” (Bouniaev, Edinbaroug & Elliott, 2014, p. 3).

World View

This research is based on a postpositivism (also called postempiricism) philosophical view. The postpositivism philosophical view refers to a view that knowledge is conjectural and that absolute truth can never be found (Colliver, 1996; Phillips & Burbules, 2000). According to postpositivist principles, evidence provided in research is fallible and has error (Trochim, 2008). Postpositivism recognizes the possible effects of researcher bias, which means knowledge, background, and values of the researcher can impact what is observed (de Gialdino, 2009). This study falls under the postpositivism philosophical framework due to numerous reasons. First, postpositivism researchers use empirical approaches for collecting information with the belief that replicable results are close to objective truth (Ryan, 2006). Second, postpositivism researchers use survey research and qualitative methods such as interviewing and participant observation (Creswell, 2008). Third, the quality standards of postpositivism, such as objectivity, validity, and reliability, can be modified by employing triangulation of data, methods, and theories (Taylor & Medina, 2013). This study matches all three aforementioned reasons, so the postpositivism framework was employed for this study.

CHAPTER II

LITERATURE REVIEW

A mixed methods research synthesis (MMRS) (Sandelowski, Barroso, & Voils, 2007; Heyvaert, Maes, & Onghena, 2013) was employed to analyze a body of articles reporting on the factors impacting the retention of Hispanic students in construction education. Sandelowski et al. (2012) defined MMRS as "a form of systematic literature review in which the findings of completed empirical qualitative and quantitative observational and experimental studies are integrated using qualitative and quantitative methods" (p. 316). MMRS investigates data collected, analyzed, and interpreted in qualitative, quantitative, and primary-level mixed studies (Heyvaert, Maes, & Onghena, 2013). By employing MMRS "- compared to 'unmixed' syntheses- more complete, concrete, and nuanced answers can be given to complex research questions" (Heyvaert, Maes, & Onghena, 2013, p. 671). In MMRS, analysis includes organizing, summarizing, and categorizing data in a form that computes the equivalent of an effect size (Simmons, Creamer, & Yu, 2017).

Data Collection

This study adopted a four-step process for data collection modeled by Borrego et al. (2014) to ensure that data represented the posed research questions. The four steps involved are as follows: (1) define the research question, (2) define the scope of inquiry, (3) find sources, and (4) apply appropriate exclusion criteria (Figure 4) (Hurwitz et al., 2016).

Defining the Research Question

This work aimed to answer the following research questions:

1) What factors contribute to increasing Hispanic student retention in construction education?
2) Which factors are most influential in increasing Hispanic student retention in construction science education programs?

Defining the Scope of Inquiry and Finding Sources

Peer-reviewed research papers published after 1990 were extracted from various databases:

- *Journal of Hispanic Higher Education*
- *International Journal of Construction Education and Research*
- ASC *Annual Conference Proceedings*
- ASCE *Journal of Professional Issues in Engineering Education and Practice*
- ASEE *Annual Conference Proceedings*
- *Journal of Engineering Education*
- ProQuest Dissertations and Theses
- Web of Science
- Google Scholar
- Scopus
- Engineering Village

Articles in peer-reviewed journals and conference papers constitute a primary source of reviewed information. To narrow the scope of search results, articles in the literature review were chosen based on the following criteria:

- Language

- Text availability
- Article type
- Publication date

Additionally, technical reports from famous effective local and national research institutes, government documents, and other literary sources were also gathered to obtain a holistic literature review (Escamilla & Ostadalimakhmalbaf, 2016).

Search terms used in search engines included the following:

- Hispanic students in construction
- Hispanic student retention
- Hispanic student persistence
- Hispanics in construction education
- Hispanic student success
- Hispanic student education

Applying Appropriate Exclusion Criteria

Inclusion and exclusion criteria were developed by accounting for the research questions. In particular, the focus was on the retention of Hispanic students in higher education. As a result, articles focusing on following areas were excluded:

- Kindergarten (K) to 12 education
- Informal education
- Professional development
- Ethnicities other than Hispanic
- Spanish or other languages

Eventually, 33articles were identified—18 quantitative studies, 13 qualitative studies, and 2 mixed methods studies. Article descriptions can be found in Table 2.

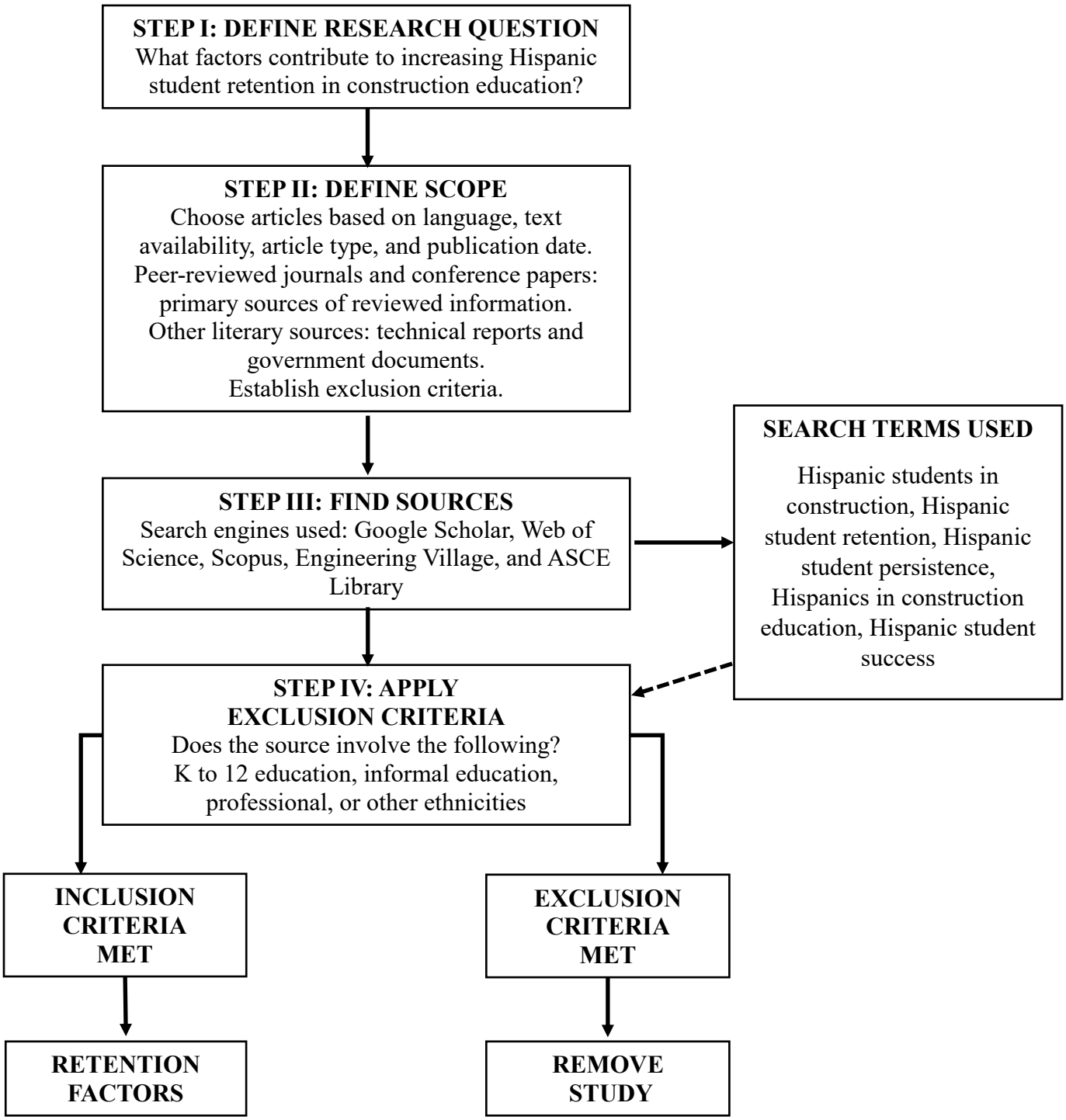

Figure 4. Flowchart of Systematic Literature Review Process (Reprinted From Hurwitz et al., 2016)

Table 2. Article Descriptions

#	Author(s)	Year	Title of the Study	Article Source	Research Method	Retention Factor(s)	Participants
1	Backer & Kato	2017	Effect of Cohorts on Student Retention in Engineering	American Society for Engineering Education	Quantitative method	Academic advising, student learning communities (lead to increased student engagement on campus), peer mentoring	322 were Hispanic students at San Jose State University (217 were engineering students)
2	Fleming	2016	Success Factors for Minorities in Engineering: Analysis of Focus Group Mini Surveys	American Society for Engineering Education	Quantitative method	Highest-performing students reserve higher ratings for study groups, project or problem-based courses, tutoring, research experience, and industry internships	The participants were 144 students (Gender composition: 58.3% males and 41.7% females; ethnic composition was 51.4% African American, 36.8% Hispanic, and 11.8% other, including Native American and international)
3	Lopez	2016	Identifying Best Practices to Increase Latino Student Enrollment and Retention at Non-Hispanic Serving Institutions	Master's Thesis	Qualitative method (interviews)	Support Hispanic identity development (hire more Latino faculty and staff, and offer Latin-American courses) Peer mentoring (help students to navigate the campus culture and connect them with its resources, Latino student mentors) Financial support (financial aid and scholarships for Latino students)	Seven individuals at six different institutions (five of the six institutions included in this study were predominantly White institutions with the exception of one): • large midwestern public institution • medium public institution in the mid-Atlantic • medium, religiously affiliated, private institution on the west coast • small, religiously affiliated, private institution in the northeast • small public institution in the northeast • large public institution in the northeast

Table 2. Article Descriptions - Continued

#	Author(s)	Year	Title of the Study	Article Source	Research Method	Retention Factor(s)	Participants
4	Contreras & Contreras	2015	Raising the Bar for Hispanic Serving Institutions: An Analysis of College Completion and Success Rates	*Journal of Hispanic Higher Education*	Quantitative method	Increase Latino faculty in Hispanic-serving institutions (HSIs), increase Latino administrators in HSIs, place greater emphasis on part-time students	Latino student outcomes at 56 HSIs (of 127) in California (14 in the California State University system and 42 community colleges)
5	Enriquez et al.	2015	Assessing the Impact of Research Experiences on the Success of Underrepresented Community College Engineering Students	American Society for Engineering Education	Quantitative method	Undergraduate research experience (performing research, designing/performing an experiment, creating a work plan, working as a part of a team, writing a technical report, creating a poster presentation, making an oral presentation)	16 freshmen and sophomore community college students who participated in the Creating Opportunities for Minorities in Engineering, Technology, and Science (COMETS) summer research internship program in 2014. Interns were predominantly male (11) and Hispanic (9).
6	Krause et al.	2015	Factors Impacting Retention and Success of Undergraduate Engineering Students	American Society for Engineering Education	Quantitative method	Cocurricular experiences: • Undergraduate research (undergraduate research initiative, Engineering Problems in Community Service [EPICS], grants in research experience for undergraduates [REU]) • Freshmen camp • Professional societies Student support programs: • Learning assistants (peer mentors) • Undergraduate teaching assistants (TAs) • Supplemental instruction • Student residential communities	21 instructors across nine science, technology, engineering, and math (STEM) departments: • 13 engineering (4 biomedical, 1 mechanical/aerospace, 2 electrical, 2 freshman, 1 materials science, 1 computer systems, and 2 civil) • 4 physics • 2 mathematics • 2 chemistry All instructors teach at a large, urban, southwest US university

Table 2. Article Descriptions - Continued

#	Author(s)	Year	Title of the Study	Article Source	Research Method	Retention Factor(s)	Participants
7	Biswas et al.	2015	STEM Workshops for Transfer and Retention Program at a Hispanic Serving Institution	American Society for Engineering Education	Quantitative method	Transfer and Retention Program (TRP) Workshop and Summer Engineering Workshop (SEW) during the summer (field trip; discussions with industry representatives, including advising and faculty mentoring; work on interdisciplinary engineering projects)	Of 51 students who participated in summer STEM workshops at Texas A&M International University, 45 students responded to the survey questions
8	Núñez	2014	Engaging Scholarship With Communities	*Journal of Hispanic Higher Education*	Qualitative method	Engaging scholarship with communities (e.g., engaging students with their courses outside of the classroom, participating in service-learning activities, REU)	Review of eight years of engaged scholarship efforts—12,000 University of Texas El Paso students with over 100 partnering agencies and schools in the region; over 100 university professors from various disciplines have engaged their students to contribute over 450,000 hours of service to the community
9	Salas et al.	2014	Mentoring Experiences and Latina/o University Student Persistence	*Journal of Hispanic Higher Education*	Qualitative method (one-on-one interviews)	Mentoring program that provided them with a sense of community and sense of belonging and a "home away from home" environment, networking, and interacting with other Latina/o students	17 Latina/o students (9 female and 8 male) participated in a university (land-grant institution in a mountain west state) mentoring program that included academic and cultural resources, involvement, and leadership opportunities

Table 2. Article Descriptions - Continued

	Author(s)	Year	Title of the Study	Article Source	Research Method	Retention Factor(s)	Participants
10	Escamilla & Trevino	2014	An Investigation of the Factors Contributing to Successful Completion of Undergraduate Degrees by the Students Enrolled in the College Assistance Migrant Program	*Journal of Hispanic Higher Education*	Qualitative method (open-ended interviewing and deeper exploration of themes as they arose during interviews)	College assistance migrant program that included faculty-student support relationships and supporting and counseling students with planning their budget toward completion of their degree	10 Hispanic students graduated from College Assistance Migrant Program (CAMP) in a southwestern university
11	Gonzalez & Pinzon	2014	A STEM Transfer and Retention Program at Texas A&M International University	American Society for Engineering Education	Quantitative method	Academic workshop that included regional field trip, guest speaker lectures; skills learned included teamwork, research, procurement of materials, problem solving, and career planning	Two-year study: 2012—16 transferring students to Texas A&M International University (all Hispanic) 2013—18 transferring students to Texas A&M International University (17 Hispanic and 1 African American)
12	Bouniaev, Edinbaroug & Elliott	2014	Lessons Learned in Establishing STEM Student Cohorts at a Border University and the Effect on Student Retention and Success	American Society for Engineering Education	Quantitative method	Establishing STEM student cohort including the following support services and programs: student meetings, professional services and seminars, mentoring networks, cohort mentors, development of skills, and sharing of resources	A total of 60 students who participated in a STEM cohort at University of Texas Brownsville (engineering: 26 of 28 were males; biology: equal number of males and females; vast majority of students were aged between 18 and 20)

Table 2. Article Descriptions - Continued

#	Author(s)	Year	Title of the Study	Article Source	Research Method	Retention Factor(s)	Participants
13	Capri et al.	2013	Development and Implementation of Targeted STEM Retention Strategies at a Hispanic-Serving Institution	*Journal of Hispanic Higher Education*	Qualitative method	New student induction (advisement materials and program, 2+2 articulation with community colleges, peer-mentoring program); academic support and success (math/science resource center, faculty development seminars, math/science curricular alignment, department student science awards); career development and mentoring (undergraduate research course credit, research symposium)	Department of Sciences at John Jay College of Criminal Justice, a federally designated minority-serving institution and HSI, with an undergraduate student population of more than 12,000 students
14	Musoba et al.	2013	The First Year: Just Surviving or Thriving at an HIS	*Journal of Hispanic Higher Education*	Qualitative method (face-to-face semistructured individual and group interviews)	Improved sense of belonging (students wanted subtle affirmation that they belonged) Improved major and career choice (greater support for career exploration and planning) Improved accountability for things students don't know (someone to guide the students through the process)	A total of 43 Hispanic and Black first-year experiences in an HSI context (research site has a majority-minority student body with 65% of the student population self-reporting Hispanic origin, 19% Black, and 15% non-Hispanic/White)

Table 2. Article Descriptions - Continued

#	Author(s)	Year	Title of the Study	Article Source	Research Method	Retention Factor(s)	Participants
15	Martin et al.	2013	The Role of Social Capital in the Experiences of Hispanic Women Engineering Majors	*Journal of Engineering Education*	Qualitative method (semistructured interviews)	Peer-mentoring, academic advising, funding or space for student organizations, promotion of student study groups, participation in social- and cultural-related student organization, scholarship	Four Hispanic women in engineering
16	Kukreti et al.	2013	Enhancing Retention and Achievement of Undergraduate Engineering Students	American Society for Engineering Education	Quantitative method	Cohort building (summer Bridge Scholars Program; cohort course scheduling; freshman supplemental collaborative learning math and science courses) Networking (academic assessment and monitoring program; monthly socials; MentorNet; community engagement program/service learning activity; industry-mentoring program; and E Portfolio) Pathway to graduate school (REU programs, research training program, research forum)	
17	Enriquez et al.	2013	Promoting Academic Excellence Among Underrepresented Community College Engineering Students through a Summer Research Internship Program	American Society for Engineering Education	Quantitative method	Summer research internship program (freshmen and sophomore community college students participating in engineering research under the supervision of a university professor and a graduate student mentor)	Community college students who participated in the COMETS summer research internship program at San Francisco State University 2011: 10 male, 2 female; 10 Hispanic, 2 Asian 2012: 11 male, 2 female, 9 Hispanic, 1 Black, 2 Pacific Islander, 1 Black

Table 2. Article Descriptions - Continued

#	Author(s)	Year	Title of the Study	Article Source	Research Method	Retention Factor(s)	Participants
18	Montalvo	2012	The Recruitment and Retention of Hispanic Undergraduate Students in Public Universities in the United States, 2000-2006	*Journal of Hispanic Higher Education*	MMRS	Economic capital (federal grant aid, state/local grant aid, student loan aid), social and cultural capital	109 US public universities
19	Marosi & Steinhurst	2012	Increasing the Retention of Under-Represented Students in Engineering Through Connections with An Industry Advisory Committee	American Society for Engineering Education	Qualitative method	Industry advisory committee (raising funds to endow the program, interacting with mentor students during the academic year by sharing multiple meals together on campus and providing a field trip to the headquarters and job site of a large civil engineering firm, helping provide professional development experiences such as internships)	11 underrepresented students who participated in the Engineering Success Alliance (ESA) program at Bucknell University College of Engineering; the ESA was implemented in 2010 and began by assisting 13 first-year members of the class of 2014 (consisted of 8 men and 5 women, 7 Hispanic, 4 Black, 1 Asian, and 1 Caucasian)
20	Abood, Manson & White	2012	Recruitment and Retention Strategies for Latino Students in Tennessee's Private 4-year Institutions	PhD Dissertation	Qualitative method (focus group and in-depth interviews)	Financial incentives (monetary assistance, scholarship) Campus community (recruit Hispanic faculty and staff internships, student advisory activities, having events/lessons/ foods/lectures that relate to the Latino culture)	The research sample consisted of 20 Tennessee Independent Colleges and Universities Association member institutions

Table 2. Article Descriptions - Continued

#	Author(s)	Year	Title of the Study	Article Source	Research Method	Retention Factor(s)	Participants
21	Sandoval-Lucero et al.	2011	Examining the Retention of Nontraditional Latino(a) Students in a Career-Based Learning Community	*Journal of Hispanic Higher Education*	MMRS	Execution of a cohort learning community project including: • Academic and social support (project coordinator counsels/advises individuals regarding program progress and organizes social activities designed to engage families and friends and connect significant people at home to students' new academic experience) • Financial support (paid-for tuition and fees; partial book assistance; opportunities to participate in professional conferences are provided)	21 Latino students (first-generation, adult students) who participated in the learning community research phase (19 females and 2 males)
22	Arana et al.	2011	Indicators of Persistence for Hispanic Undergraduate Achievement: Toward an Ecological Model	*Journal of Hispanic Higher Education*	Qualitative method (individual interviews and focus groups)	Faculty and university support (passionate faculty as a major source of encouragement); creating a shared cultural experience for Hispanic students (events cater to Mexican-American culture, history, music, and dance)	33 Hispanic (both men and women) students both currently and formerly enrolled (16 current students, 11 previous students who did not persist, 6 college graduates who are successful professionals) at a private HSI located in the southwestern US
23	Jones, Rusch & Dugas	2011	Impacting the Success of Under-represented Minorities at Louisiana State University: A Diversity Scholarship and Mentoring Partnership with ExxonMobil	American Society for Engineering Education	Quantitative method	Mentoring program with ExxonMobil employees (one-on-one mentoring, coordinated workshops with mentors and protégés, mentors help scholars with professional development and career planning) Financial support for the scholarship program (ExxonMobil contributed $250,000 over five years to establish a scholarship fund)	Phase 1: 19 students at Louisiana State University College of Engineering participated (26% female, 74% male, 21% Hispanic, 74% African American) Phase 2: 13 Students at Louisiana State University College of Engineering participated (38 female, 62% male, 77% African American, 23% Hispanic)

Table 2. Article Descriptions - Continued

#	Author(s)	Year	Title of the Study	Article Source	Research Method	Retention Factor(s)	Participants
25	Crisp & Nora	2010	Hispanic Student Success: Factors Influencing the Persistence and Transfer Decisions of Latino Community College Students Enrolled in Developmental Education	*Research in Higher Education Journal*	Quantitative method	Receipt of financial support, enrollment in developmental courses	570 Hispanic students who first enrolled at a 2-year public community college in 2003–2004 and who planned to transfer to a 4-year institution
26	Cejda & Hoover	2010	Strategies for faculty-student engagement: How community college faculty engage Latino students	*Journal of College Student Retention: Research, Theory & Practice*	Qualitative method (semistructured interviews)	Establish a learning community within the classroom (encourage small-group interaction focusing on course content at the beginning and end of each class or during class as "checkpoints" before moving to new material); develop personal relationships with students	41 interviews: 14 at a rural community college, 14 at an urban community college, and 13 at a suburban community college 90% of interviewees held faculty positions, and one person held a combined faculty/professional staff position.
27	Cerna et al.	2009	Examining the Precollege Attributes and Values of Latina/o Bachelor's Degree Attainers	*Journal of Hispanic Higher Education*	Quantitative method	Social and cultural capital (student protests, community service–related work, religious activities during college) Economic capital (receive financial assistance to quell college cost concerns) Increased number of Latina/os enrolled on campus and increased number of Latina/o peers on campus	Overall sample n = 48,846 (from 262 public and private 4-year institutions that participated in the Cooperative Institutional Research Program [CIRP] 1994) The selected sample for this study comprised 2,957 entering Latina/o college students, including 1,323 Mexican-American students, 569 Puerto Rican students, and 1,065 students from all other Latina/o groups

Table 2. Article Descriptions - Continued

#	Author(s)	Year	Title of the Study	Article Source	Research Method	Retention Factor(s)	Participants
27	Oseguera et al.	2009	Increasing Latina/o Students' Baccalaureate Attainment	*Journal of Hispanic Higher Education*	Qualitative method	Creating inclusive and responsive campus environments, civic engagement (sponsoring cultural events, facilitating structured intergroup dialogue, and including educational activities with a focus on ethnicity and culture), diverse faculty and staff (Latina/o faculty members and administrators send message of inclusivity, serve as role models, and serve as cultural liaisons between Latinas/os and higher-education culture)	
28	Crown et al.	2009	AC 2009-1900: Student Academic Advisement: Innovative Tools for Improving Minority Student Attraction, Retention, and Graduation	American Society for Engineering Education		Monitoring and academic advising of students (proposed workload and reasonable progress toward graduation, evaluation of grades, course prerequisites, graduation requirements, transfer/College Level Examination Program [CLEP] credits, university requirements, and early warnings) Mentoring students (professional opportunities for students, answering questions about career choices, encouraging good habits, building a relationship, financial aid/scholarships, and selection of technical electives appropriate to student interest and career goals)	Study analyzed a refined advisement process among 500 mechanical engineering undergraduate students (82.3% Hispanic, 17% female) at University of Texas Pan American
29	Serrata	2009	Successful Hispanic Male First-Time-in-College Students at a Community College in South Texas: Experiences That Facilitate Fall First-Term Student Persistence Through Official Reporting Date.	PhD Dissertation	Qualitative method (focus group interviews, semistructured interviews)	Financial aid/financial aid process (student loans including additional emergency loans that would provide a short-term solution)	18 Hispanic male first-time-in-college students at South Texas College

Table 2. Article Descriptions - Continued

#	Author(s)	Year	Title of the Study	Article Source	Research Method	Retention Factor(s)	Participants
30	Torres & Hernandez	2009	Influence of an Identified Advisor/Mentor on Urban Latino Students' College Experience.	*Journal of College Student Retention: Research, Theory & Practice*	Quantitative method	Advising/mentoring programs/mentoring (help Latino students navigate the college environment; provide students with greater levels of support and knowledge about the behaviors that will lead to academic success)	541 students at three institutions (two of the institutions are HSIs): 64% females, 77% of the students are first-generation college students and the majority claim Mexico as their country of origin, followed by Puerto Rico, Cuba, El Salvador, and other countries
31	Maestas et al.	2007	Factors Impacting Sense of Belonging at a Hispanic-Serving Institution	*Journal of Hispanic Higher Education*	Quantitative method	Improved sense of belonging (student attachment to the various communities or university contexts) Academic integration (participating in academic support program, having classes with peer discussions/interactions, faculty taking in student development) Social integration (joining a sorority or fraternity, holding a campus leadership position, living in campus housing)	421 students at University of New Mexico (69% female and 31% male; 33% Hispanic, 9% other minority, and 58% White)
32	Davis et al.	2007	AggiEmentor: Improving the retention of Undergraduates in STEM Areas via E-mentoring	*American Society for Engineering Education*	Quantitative method	Electronic mentoring providing support, encouragement and career development (providing students with the opportunity to be matched with working professionals who can help them with time management, career counseling, and other life skills that will enable them to be successful as a student and future employee)	44 of 101 students who registered for the E-mentoring program at North Carolina A&T State University (0.99% American Indian or Alaska Native, 3.96% Asian/Asian American, 86.14% Black/African American, 3.96% Hispanic or Latina/o, 4.95% White)

Table 2. Article Descriptions - Continued

#	Author(s)	Year	Title of the Study	Article Source	Research Method	Retention Factor(s)	Participants
33	Cantu	2004	An Identification of Policies and Practices That Hinder and Facilitate the Admission and Retention of Hispanics in Institutions of Higher Education in Texas	PhD Dissertation	Quantitative method	Academic and career counseling and mentoring Financial aid (financial aid, loans, work study, and grants) On- and off-campus work study and internship Student initiatives (social support activities, student-to-student mentor programs, and Hispanic student organizations and clubs) Other retention initiatives (learning communities, web-based instruction, etc.)	11 expert panelists from Texas (nine working in a college and/or university setting, one working in an educational private, nonprofit organization that deals with K to university issues, and one Texas legislator who votes on legislative issues dealing with colleges and universities

Data Analysis

Inductive Analysis

The different retention initiatives positively impacting Hispanic students were analyzed inductively using the extracted information. Initial line-by-line coding (or free coding) was conducted to develop specific codes (e.g., fellowship, industry mentoring, degree evaluation, etc.). Then, 125 initial codes were sorted as factors that influence Hispanic students' retention (Table 3).

Table 3. Initial Line-by-Line Coding (Free Coding)

Codes	#
Financial aid, Provide Economic Capital, Federal grant aid, State/local grant aid, Student loan aid, Financial support, Paying tuition and fees, Partial book assistance, Financial aid stipends, Financial Resource, Scholarship, Financial Incentives, Monetary assistance, Funding, Federal Pell Grants	15
Student organizations, Professional societies, Provide space for student organization, Student competition	4
Tutoring, Tutorial labs, Math and science resource center, Writing center	4
Advisement materials and program (one-on-one advising, mandatory weekly meeting, intensive counseling , academic counseling), Personal counseling (proposed course workload and reasonable progress toward graduation, evaluation of grades, course prerequisites, graduation requirements, transfer/CLEP credits, university requirements, early warnings, student advisory activities)	15
Career counseling (assisting students in expanding their vocational aspirations, career advising, industry internships, career planning), Industry advisory committee, Career fair	7
Participating in professional conferences/competitions/workshops, Field trip to the headquarters and job site, Regional field trip, Guest speaker lectures, Skills learned (teamwork, research, procurement of materials, problem solving), Discussions with industry representatives, Work on interdisciplinary engineering projects	11
Participating in service-learning activities, Engagement of students with their courses outside of the classroom, Community service learning, More interactive inside and outside classroom learning strategies, Use of learning communities, Encouraging small group interaction focusing on course content at the beginning and end of each class or during class, Student learning communities	6
Undergraduate research course credit, Research symposium, Research training, Opportunities to interact and network with faculty across all three campuses, Personal faculty advisor, Publication dissemination opportunities, Summer research internship program, Writing a technical report, Creating a poster presentation, Making an oral presentation, Performing research, Designing/performing an experiment, Creating a work plan	14

Table 3. Initial Line-by-Line Coding (Free Coding) – Continued

Codes	#
Events catered to Mexican-American culture/history/music/ dance, Joining a sorority/fraternity, Holding a campus leadership position, Living in campus housing, Participating in student protests, Participating in community service–related work, Participating in religious activities during college, Hispanic organization on campus, Developing relationships on campus, Civic engagement, Shared cultural experience, Having events/lessons/foods/lectures related to the Latino culture	15
One-on-one mentoring, Assigned mentor, Student-to-student mentor programs, Electronic mentoring, Providing support and encouragement (opportunity to be matched with working professionals, development of professionals skills such as time management, life skills, professional opportunities for students, answering questions about career choices, encouraging good habits, building a relationship, and selecting technical electives appropriate to student interest and career goal), Coordinated workshops with mentors and protégés, Interaction with mentor students during the academic year through sharing multiple meals together on campus, Industry mentoring program, Peer mentoring for a sense of community and belonging and a "home away from home" environment, Networking and interacting with other Latina/o students	23
Increased Latino faculty in HSIs, Increased Latino administrators in HSIs, Diverse faculty and staff, Cultural liaisons between Latinas/os and higher-education culture, Serving as role models to student, Recruiting Hispanic faculty and staff, Hiring more Latino faculty and staff, Supporting Hispanic identity development	8
Increased number of Latina/os enrolled on a campus, Increased number of Latina/o peers on campus, Having classes/discussions/interactions with peers	3

Initial codes were organized into 12 categories of retention factors, employing a higher level of abstraction. For instance, the initial codes related to career fairs and internships were grouped into the *Career development program* category (Table 4). "This process required decisions about what categories made the most analytic sense to organize the initial codes inclusively and completely" (Simmons, Creamer, & Yu, 2017, p.11). The literature reviewed proposed 12 retention factors:

- Financial aid
- Construction-related student organizations
- Tutorial services
- Academic advising

- Career development programs
- Academic workshops
- Construction-oriented learning communities
- Undergraduate research experience
- Extracurricular activities
- Mentoring programs
- Hispanic faculty members in the construction program
- Hispanic peers and students in the construction program

The description for each retention factor is stated in Table 4.

Table 4. Retention Factors Impacting Hispanic Students

#	Retention Factor	Description of Factor
1	Financial aid	Refers to scholarship, fellowship, support for tuition, books, and fees
2	Construction-related student organizations	Refers to students organizations such as Associated Builders and Contractors (ABC), Associated General Contractors (AGC), NAHB, Construction Managers Association of America (CMAA), as well as funding or space for student organizations
3	Tutorial services	Refers to services such as math and science resource center and writing center
4	Academic advising	Refers to proposed course workload and reasonable progress toward graduation, evaluation of grades, course prerequisites, graduation requirements, transfer/CLEP credits, university requirements, and early warnings
5	Career development programs	Refers to career counseling, assisting students in expanding their vocational aspirations, industry internships, and career planning
6	Academic workshops	Refers to participation in professional conferences, competitions, workshops, regional field trip, and guest speaker lectures
7	Construction-oriented learning communities	Refers to participation in service-learning activities, engagement of students with their courses outside of the classroom, community service learning, and student learning communities
8	Undergraduate research experience	Refers to participation in research symposium, undergraduate research course credit, writing a technical report, creating a poster presentation, making an oral presentation, performing research
9	Extracurricular activities	Refers to participation in social- and cultural-related organizations and activities such as sorority, fraternity, student protest, religious activity, and event catering to Hispanic culture/history/music/dance
10	Mentoring programs	Refers to peer mentoring, industry mentoring, coordinated workshops with the mentors and protégés, the opportunity to be matched with working professionals, and development of professionals skills
11	Hispanic faculty members in the construction program	Refers to recruiting Hispanic faculty and staff and hiring more Latino faculty and staff
12	Hispanic peers and students in the construction program	Refer to an increased number of Latina/os enrolled on a campus and an increased number of Latina/o peers on campus

Frequency Calculation

The frequency of each retention factor was analyzed by counting the number of articles that reported various categories of factors (Table 5).

Table 5. Frequency Calculation

Retention Initiative Category	Frequency	Percentage	Rank
Mentoring programs	15	45.45%	**1**
Academic advising	12	36.36%	**2**
Financial aid	11	33.33%	**3**
Construction-oriented learning communities	9	27.27%	**4**
Extracurricular activities	8	24.24%	**5**
Undergraduate research experience	7	21.21%	**6**
Career development programs	7	21.21%	**6**
Hispanic faculty members	6	18.18%	**8**
Academic workshops	3	9.09%	**9**
Hispanic peers and students in the construction program	2	6.06%	**10**
Tutorial services	2	6.06%	**10**
Construction-related student organizations	1	3.03%	**12**

The details for each retention factor can be found in Table 6.

Table 6. Details for Each Retention Factor

	Article #															
Retention Initiative Category	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Mentoring programs	✓		✓			✓	✓		✓			✓	✓		✓	✓
Academic advising	✓									✓			✓	✓	✓	✓
Financial aid			✓			✓										
Construction-oriented learning communities	✓	✓				✓		✓							✓	✓
Undergraduate research experience		✓			✓	✓		✓					✓			✓
Extracurricular activities															✓	
Career development programs		✓									✓		✓	✓		
Hispanic faculty members in the construction program			✓	✓						✓						
Tutorial services		✓											✓			
Academic workshops							✓				✓					
Hispanic peers and students in the construction program			✓													
Construction-related student organizations															✓	

Table 6. Details for each Retention Factor - Continued

	Article #																
Retention Initiative Category	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Mentoring programs	✓		✓				✓					✓				✓	✓
Academic advising				✓	✓							✓		✓		✓	✓
Financial aid		✓	✓	✓	✓		✓	✓		✓			✓				✓
Construction-oriented learning communities									✓						✓		✓
Undergraduate research experience	✓																
Extracurricular activities		✓		✓		✓				✓	✓				✓		✓
Career development programs			✓	✓													✓
Hispanic faculty members in the construction program				✓		✓					✓						
Tutorial services																	
Academic workshops			✓														
Hispanic peers and students in the construction program										✓							
Construction-related student organizations																	

Summary

This section employed MMRS to analyze a body of empirical articles reporting on the factors impacting the retention of Hispanic students in higher education. This study adopted a four-step process for data collection including: (1) define the research question, (2) define the scope of inquiry, (3) find sources, and (4) apply appropriate exclusion criteria. Eventually, 33articles were identified—18 quantitative studies, 13 qualitative studies, and 2 mixed methods studies.

The different retention initiatives positively impacting Hispanic students were analyzed inductively using the extracted information. Initial line-by-line coding (or free coding) was conducted to develop specific codes. Then, 125 initial codes were sorted as factors that influence Hispanic students' retention. Initial codes were organized into 12 categories of retention factors, employing a higher level of abstraction. The 12 categories of retention factors include: financial aid, construction-related student organizations, tutorial services, academic advising, career development programs, academic workshops, construction-oriented learning communities, undergraduate research experience, extracurricular activities, mentoring programs, Hispanic faculty members in the construction program, and Hispanic peers and students in the construction program

The frequency of each retention factor was analyzed by counting the number of articles that reported various categories of factors. As a result, the 12 categories of retention factors were ranked as follows:

1. Mentoring programs
2. Academic advising
3. Financial aid
4. Construction-oriented learning communities

5. Extracurricular activities
6. Undergraduate research experience
7. Career development programs
8. Hispanic faculty members
9. Academic workshops
10. Hispanic peers and students in the construction program
11. Tutorial services
12. Construction-related student organizations

This study aimed to identify which factors have the strongest effect to assist undergraduate construction programs in determining where best to focus retention strategies to enhance Hispanic student success.

CHAPTER III

METHODOLOGY

This section details the procedures performed during the research work. The Delphi method was used to identify the weight of each factor. This method is a systematic and interactive research approach for reaching consensus among a panel of experts (Hallowell, Esmaeili & Chinowsky, 2011). When employing this method, panel members are chosen based on particular guidelines and are invited to participate in two or more rounds of structured surveys (López-Arquillos et al., 2014). After each round, an anonymous summary of the experts' input from the previous round is provided as feedback to the panel members. In each subsequent round, participants are encouraged to review the responses of other panelists and consider revising their previous response (López-Arquillos et al., 2014). The process is concluded after a predefined criterion is achieved (e.g., number of rounds or achievement of consensus) (Hallowell et al., 2011). A flowchart of the Delphi method is shown in Figure 5. This study employed the Delphi method on two levels:

- Academic level (Experiment group)—consisting of academic experts in the area of construction education or Hispanics in construction education
- Construction industry level (Control group)—consisting of professionals working in the construction industry who graduated with an undergraduate degree in construction education

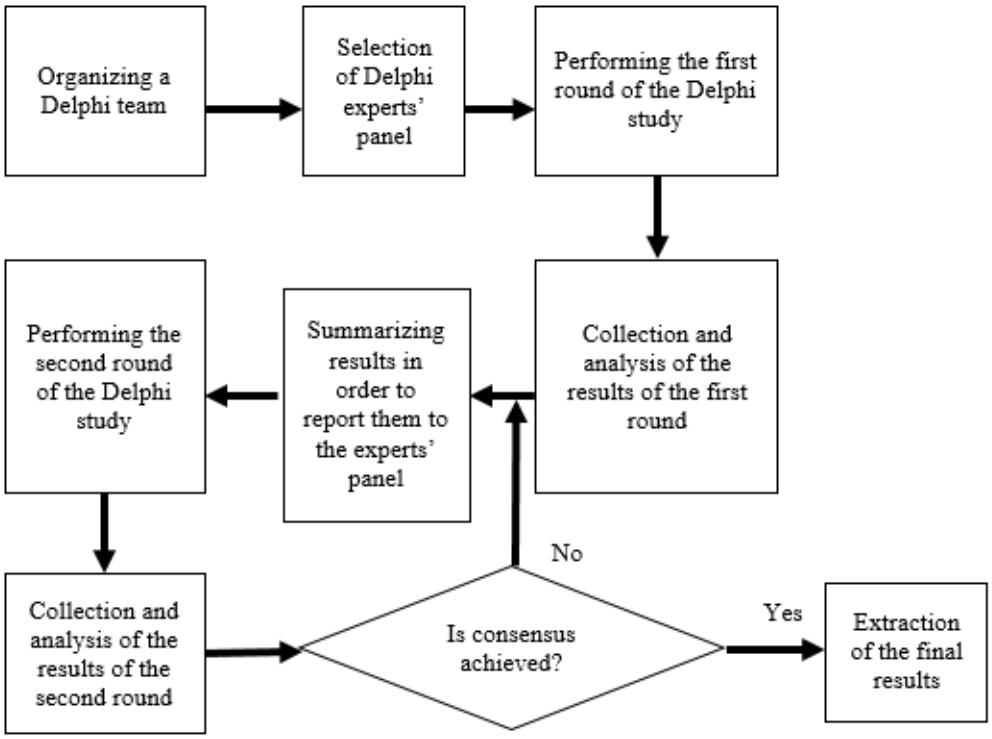

Figure 5. Delphi Method Process (Reprinted from Mozaffari et al., 2012)

Interface with Institutional Review Board

In order to comply with the laws and regulations governing human subject research, all research projects involving human subjects conducted by Texas A&M faculty/staff or using students as subjects must be reviewed and approved by the Texas A&M University Institutional Review Board (IRB) (Institutional Review Board, n.d.). Because this research used a survey instrument and interviews with people to gain data related to Hispanic student retention, the researcher obtained IRB approval prior to any data collection. Because the research procedures did not place subjects at legal or personal risk, the "expedited" type of IRB was submitted.

Justification for Using the Delphi Method

- By reviewing relevant literature, Sourani and Sohail (2015) concluded that the Delphi method can be useful when there is a need to
  - "study or define areas where there is considerable uncertainty and/or a lack of agreed knowledge or disagreement
  - allow for combining fragmentary perspectives into a collective understanding
  - model a real world phenomena involving a range of viewpoints and for which there is little established quantitative evidence
  - highlight topics of concern and assess uncertainty in a quantitative manner
  - obtain accurate information that is unavailable or expensive to obtain
  - handle complex problems that require more judgmental analysis.
- Compared to questionnaire surveys, the Delphi method offers better interaction with respondents and could potentially provide more understanding of complex problems (MacCarthy & Atthirawong, 2003; Mullen, 2003)" (p. 57)
- The Delphi method is useful when the opinions and judgments of experts and practitioners are necessary. It is especially appropriate when it is not possible to convene experts in one meeting (Kirun &Varghese, 2015).
- The Delphi method has seen increased use for construction engineering and management research since the early 1990s (Ameyaw et al., 2016, Hallowell & Gambatese, 2010).

Selection of Delphi Panelists

Selecting well-qualified, well-rounded, and diverse panel members is one of the most critical facets of the Delphi method in order to ensure minimal bias and increase internal and

external validity (Hallowell, Esmaeili & Chinowsky, 2011). For the academic level (experiment group), this study employed criteria recommended by Hallowell and Gambatese (2010) to qualify an individual as a panel "expert." Specifically, an identified academic expert scored a minimum of 11 total points in an expert evaluation system, shown in Table 7, to qualify for participation in the academic level of study.

Table 7. Expert Evaluation System (Reprinted from Hallowell & Gambatese, 2010)

Achievement or Experience	Points (Each)
Professional registration	3
Years of professional experience	1
Conference presentation	0.5
Member of a committee	1
Chair of a committee	3
Peer-reviewed journal article	2
Faculty member at an accredited university	3
Writer/editor of a book	4
Writer of a book chapter	2
Advanced degree:	
BS	4
MS	2
PhD	4

Table 8. Academic Expert Characteristics

Academic Expert ID	Professional registration	Working experience in the field of construction	Teaching experience in the field of construction	Written a report for the construction industry	Conference presentation	Peer-reviewed journal article	Faculty member at an accredited university	Written a book chapter	BS	MS	PhD	Min of 11
P 1		✓			✓				✓			Yes
P 2	✓	✓			✓				✓			Yes
P 3	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Yes
P 4	✓	✓		✓	✓	✓		✓	✓			Yes
P 5					✓	✓			✓	✓	✓	Yes
P 6			✓	✓			✓		✓	✓		Yes
P 7		✓	✓		✓	✓	✓	✓	✓	✓	✓	Yes
P 8		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Yes
P 9		✓	✓			✓	✓		✓	✓	✓	Yes
P 10	✓	✓	✓				✓		✓	✓		Yes
P 11		✓	✓		✓		✓		✓	✓		Yes
P 12	✓	✓	✓				✓		✓			Yes
P 13	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Yes
P 14	✓		✓	✓	✓	✓	✓		✓	✓	✓	Yes
P 15	✓	✓	✓				✓		✓	✓		Yes
P 16		✓	✓		✓	✓	✓		✓	✓	✓	Yes

Table 8. Academic Expert Characteristics - Continued

Academic Expert ID	Professional registration	Working experience in the field of construction	Teaching experience in the field of construction	Written a report for the construction industry	Conference presentation	Peer-reviewed journal article	Faculty member at an accredited university	Written a book chapter	BS	MS	PhD	Min of 11
P 17		✓	✓				✓	✓	✓	✓		Yes
P 18	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Yes
P 19	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Yes
P 20	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Yes
P 21	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	Yes
P 22		✓	✓		✓		✓		✓	✓		Yes
P 23		✓	✓		✓	✓			✓	✓		Yes
P 24		✓	✓		✓	✓	✓		✓	✓	✓	Yes
P 25	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Yes
P 26		✓	✓				✓		✓			Yes
P 27		✓	✓		✓	✓	✓		✓	✓	✓	Yes

The academic experts (experiment group) identified for participating in this study mainly came from 6 distinct programs identified by the Associated School of Construction (ASC) Region V in Texas, as well as experts who came from other 5 distinct colleges/universities in Texas. The characteristics of the academic experts are presented in Table 8.

For the industry level, panelists consisted of construction professionals who held an undergraduate degree in construction education. The industry professional panelists (control group) in this study came from 11 distinct contractors in Texas.

Characteristics of Delphi panelists for the industry level are presented in Table 9.

Table 9. Industry Expert Characteristics

Industry Expert ID	Years working in the field of construction	Job title	Degree	Ethnicity	Gender
P 1	18	Construction Project Manager	BS	Hispanic/ Latino	Male
P 2	1.5	Project Engineer	BS	Hispanic/ Latino	Male
P 3	2	Estimator	BS	Hispanic/ Latino	Male
P 4	37	Project Manager	BS	Hispanic/ Latino	Male
P 5	1	Construction Project Engineer	BS	Hispanic/ Latino	Female
P 6	8	Project Engineer	BS	Hispanic/ Latino	Male
P 7	2	Field Engineer	BS	Hispanic/ Latino	Female
P 8	2+	Field Engineer	BS	White	Male
P 9	1	Assistant Project Manager	BS	Hispanic/ Latino	Male
P 10	2	Estimator	BS	Hispanic/ Latino	Male
P 11	26	President of the Company	MS	Hispanic/ Latino	Male
P 12	36	President of the Company/CEO	BS	White	Male
P 13	7	VDC Coordinator	BS	Hispanic/ Latino	Male
P 14	13	VP of Operations	BS	White	Male
P 15	3	Assistant Project Manager	BS	White	Male
P 16	20	Project Executive	BS	White	Male
P 17	0.5	Assistant Superintendent	BS	Hispanic/ Latino	Female
P 18	26	Executive Project Manager	BS	Hispanic/ Latino	Male
P 19	11	Project Manager II	BS	White	Male
P 20	5	Superintendent	Unknown	White	Unknown
P 21	10	Project Manager	BS	Hispanic/ Latino	Male
P 22	0.6	Graduate Student Researcher	BS	Hispanic/ Latino	Male
P 23	17	Assistant Director of Facilities	BS	Hispanic/ Latino	Male
P 24	8	BIM Coordinator	BS	Hispanic/ Latino	Male
P 25	2.5	Project Engineer	BS	Hispanic/ Latino	Male
P 26	5	Project Engineer	BS	White	Male

Delphi Rounds

The goal of performing multiple rounds in the Delphi method is to obtain consensus among panelists (Sourani & Sohail, 2015), along with improving precision by using controlled feedback and an iterative process (Hallowell & Gambatese, 2010). While literature is inconclusive on the optimal number of rounds for the Delphi method, this study involved three iterations for the following reasons:

- After reviewing 88 papers in construction engineering and management, Ameyaw et al. (2016) reported that 40 reached desired consensus after two and three rounds.
- Studies involving only two rounds are not sufficiently capable of identifying outlying viewpoints, obtaining justification, or sharing this information with other panelists (Hallowell & Gambatese, 2010).
- Responses are more likely to obtain consensus on the correct value rather than conforming to an incorrect opinion after the second round (Hallowell & Gambatese, 2010).
- Hasson et al. *(*2000) stated that the researcher should take into account participant fatigue, attrition rate, time, and cost if the research involves more than three rounds (Ameyaw et al., 2016). In addition, research shows that the number of experts participating in a study decreases after round two (Chan et al., 2001; Rajendran & Gambatese, 2009; Xia et al., 2011).

This study included three rounds for the academic level (experiment group) and two rounds for the industry level.

Number of Expert Panelists

While previous literature provides no particular guidelines on the number of Delphi panelists, as shown in Table 10, of 67 studies using the Delphi method in the area of construction engineering and management, a majority involved 8 to 20 members (Ameyaw et al., 2016). In contrast to traditional statistical surveying, the goal of the Delphi method is not to select a representative sample of the population, but rather to yield more accurate results by experts in their field (Kirun & Varghese, 2015).

Table 10. Panel Size in Identified Delphi papers (Reprinted from Ameyaw et al., 2016)

Panel Size	3–7	8–20	21–30	31–40	41–50	51+	Total
Frequency	7	41	9	5	4	1	66

The panel sizes for both academic experts (experiment group) and construction industry professionals (control group) are shown in Table 11.

Table 11. Panel Sizes of the Study

Delphi Panelist Type	Round One	Round Two	Round Three
Academic Experts	6	27	19
Construction Industry Professionals	-	26	16

Description of Each Delphi Round

Round one

This round aimed to further refine the retention factor list identified through the literature review with open-ended interviews with academic experts (experiment group). Round one intended to use interview data as an indication of nonpublished perspectives by the board of experts

on the retention of Hispanic students in in undergraduate construction education. In this round, qualitative data coding was used to search for any themes present.

Hence, different responses were produced by interviewing six academic experts (experiment group). By categorizing the responses, six unique themes emerged:

- Family unit financial support
- Being a first-generation college student
- Having a family member in the construction industry
- Educational background (high school GPA)
- Racial discrimination
- Math and physics courses

The aforementioned themes are either associated with barriers to retaining Hispanic students or are categorized as precollege retention factors. The current study focused on which retention strategies are most influential in retaining Hispanics in undergraduate construction education. Therefore, the retention factor list identified through the literature review was not refined or changed. This round took 10 days.

Round two

This round aimed to ask panelists (both academic experts and construction industry professionals) to evaluate the level of importance of each factor impacting the retention of Hispanic students in undergraduate construction education. By analyzing the literature review findings and the results obtained from round one, the Delphi round two questionnaire was developed. Data in this round were gathered using a self-administered, researcher-designed survey instrument. The survey utilized Likert-type scale, multiple choice, and ranking order questions. The survey questionnaire was divided into two sections. Section one collected key demographic information

such as ethnicity, gender, current situation, and experience with the construction industry. Section two was designed to capture information about panelist perspectives on the factors impacting Hispanic student retention in undergraduate construction education using Likert-type scale and a ranking order questions. For instance, panelists were asked to rank the factors impacting Hispanic student retention in construction science education programs. The average ranking for each choice of the ranking question was calculated according to the following formula:

Average ranking = $[X_A W_A + X_B W_B + \cdots + X_G W_G] \div Total$ (Liu & Wu 2017)

W represents the weight of ranked position, and the question had 12 choices. X represents the response count for the answer choice. If three respondents ranked a factor first, then $X_{\text{the factor}}$ was 3. "Total" refers to the number of respondents filling in the questionnaire (Liu & Wu 2017).

For the control group, round two was broken into three sections: demographic information, rating the retention factors by importance using a five-point Likert-type scale, and ranking the factors impacting Hispanic student retention in construction science education (allocating 1 to the most important factor and 12 to the least important factor).

In order to identify any weaknesses in the survey associated with wording or format that could result in incorrect understanding or inaccurate interpretation of the survey questions, the survey was reviewed by three academic experts and was revised based on feedback to ensure it would collect the desired information. The survey was administered using SurveyMonkey. Participation was voluntary, and participant information remained confidential. This round took 30 days.

Round three

This round aimed to provide Delphi panelists with the opportunity to reconsider the scores they provided in round two. By analyzing the results obtained from round two, the Delphi round

three questionnaire was developed. The round three survey included only one ranking order question. Based on feedback from the academic experts (experiment group) regarding the ranking order question in round two, it was difficult for them to compare 12 factors simultaneously. As posited by Miller's law (1956), there are limits on the human mind's capacity for processing information; an individual normally can compare only 7 ± 2 items at the same time. Taking Miller's law into account and consulting with the advisory committee, ranking order questions in this round comprised eight of the most important retention factors from round two. This round took 15 days.

Statistical Analysis Tests for the Delphi Data

In order to improve the validity of the study, intergroup analysis was applied before combining data to test for any substantially similar agreement among respondents (Hon et al., 2012). All statistical analyses were conducted using IBM SPSS Statistics version 23, and statistical significance was set at $p < 0.05$. Descriptive statistics were used to summarize the results of questionnaires. In addition, nonparametric Mann-Whitney U and Kruskal-Wallis H testing was conducted at a significance level of 0.05 ($\alpha = 0.05$) to examine any statistically significant difference between responses of different subgroups based on respondent gender, ethnicity, highest completed degree, area of degree, teaching experience, and working experience.

To evaluate the existence of any statistically significant difference between responses of different subgroups, nonparametric Mann-Whitney U and Kruskal-Wallis H testing was performed for ordinal variables with two levels and more than two levels, repectively. For nominal variables, first the distribution normality of data was checked using a Shapiro-Wilk test because samples were smaller than 25 units. When data were not normally distributed, Mann-Whitney U and

Kruskal-Wallis H testing was used for nominal variables with two levels and more than two levels, respectively. P-values less than 0.05 were considered statistically significant.

While, "there is no agreement on the minimum value of standard deviation, under which the consensus of the Delphi survey could be accepted, some researchers accepted the ratio of 30% that standard deviation value against a mean value of a data set" (Ameyaw et al., 2016, p. 995). As a result, this study used the aforementioned criterion for the consensus measurement among Delphi panelists.

Limitations

The limitations of the study include (but are not limited to) the following:

- Data were gathered among a specific number of experts, and not all experts in the area of Hispanic student retention in Texas were represented, which limits the generalizability of the findings.
- The Delphi method was time-consuming for both the researcher and panel member experts.
- Because panelists had busy schedules, dropout occurred because of the requirement to respond to several rounds.

Assumptions

The following were assumed:

- Panelist responses were honest and unbiased.
- The researcher remained impartial during data collection and data analysis.
- Interpretation Of The Information Gathered Correctly Reflects That Which Was Intended.

CHAPTER IV

ANALYSIS OF THE DATA

Academic Experts (Experiment Group)

A majority of panelists (81.5%, 22 of 27) were male, and five (18.5%) were female. Approximately half the respondents (55.6%) reported completing their PhD, and 25.9% and 18.5% reported a master's and bachelor's degree, respectively, as their highest completed degree.

The degree area of participants was categorized into three distinct groups (Table 12). The highest percentage was related to a construction-oriented degree area (74.1%) (Figure 6). Nonconstruction-oriented education degrees accounted for 18.5%. Only 7.4% of respondents had neither a construction- nor an education-oriented degree (Figure 7).

Table 12. Categorization of Experiment Group Degree Area

Degree Area	Category of Degree Area
Construction Engineering/Project Management	Construction-Oriented
Construction and Land Development	
Landscape Architecture and Urban Planning	
Environmental Design and Planning	
Architecture	
Architectural Design	
Civil Engineering	
BS CE MS EE*	
Civil and Environmental Engineering	
Health Protection Engineering	
Leadership Studies	
Technology Management	
Industrial Engineering BS 1969 Texas Tech	
Professional Education	Nonconstruction-Oriented But Education-Oriented
Educational Psychology	
Higher Educational Administration	
Agricultural Leadership Education and Communication	
Political Science	Neither Construction- Nor Education-Oriented

*BS CE MS EE: Bachelor of Science, Civil Engineering; Master of Science, Electrical Engineering

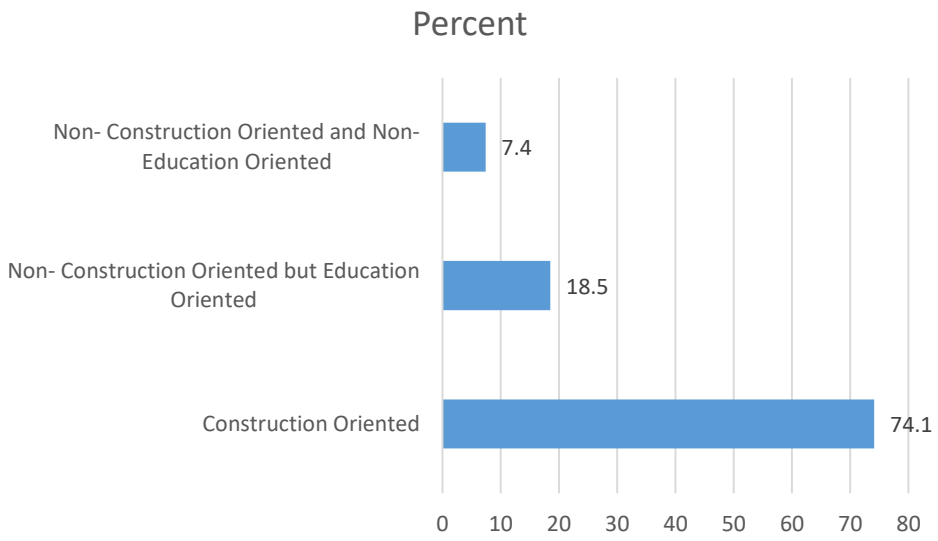

Figure 6. Percentage of degree areas for experiment group

As shown in Table 9 and Figure 7, over half the respondents (66.7%) had been in a teaching position. Moreover, the results indicate that a majority of participants (77.8%) had teaching experience, and over half of all participants (66.6%) had taught more than 5 years (Figure 8).

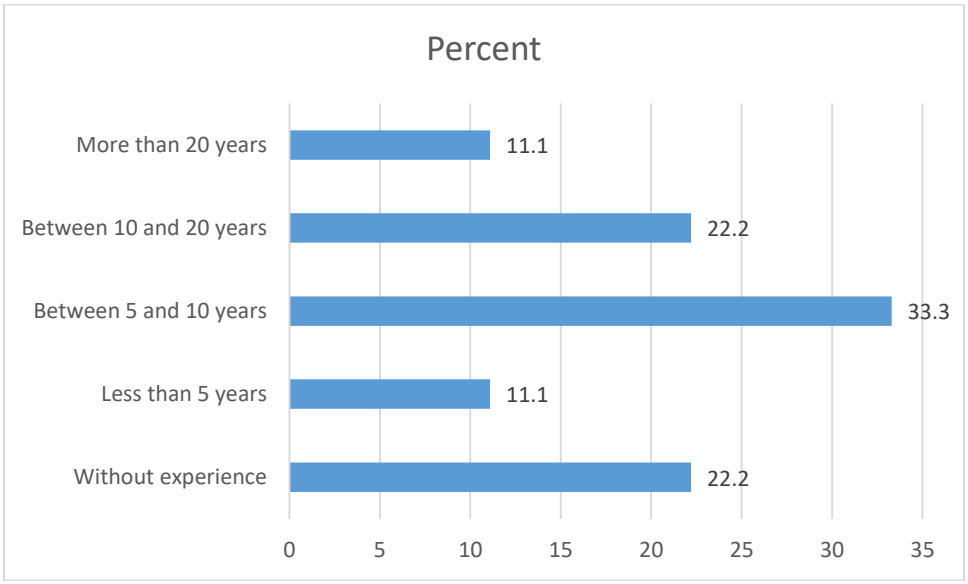

Figure 7. Percentage of each group with specific teaching experience

Only 33.3% of panelists had no experience in the field of construction. Over half the participants (66.7%) had working experience in the field of construction, and over half of all participants (100.0% – 40.7% = 59.3%) had worked in the field of construction for more than 5 years (Figure 9).

Regarding ethnicity, a majority of participants (81.5%) were either White or Hispanic/Latino (Figure 10). Less than half of all panelists (37%) were either Hispanic or Latino (Figure 11).

Roughly half the participants held a professional registration. Most participants (70.4%) had presented at conferences. Less than half the participants (40.7%) stated that they had written a report for the construction industry. Nearly half the participants (55.6%) reported publishing a peer-reviewed journal article. Less than half the participants (40.7%) reported writing a book chapter.

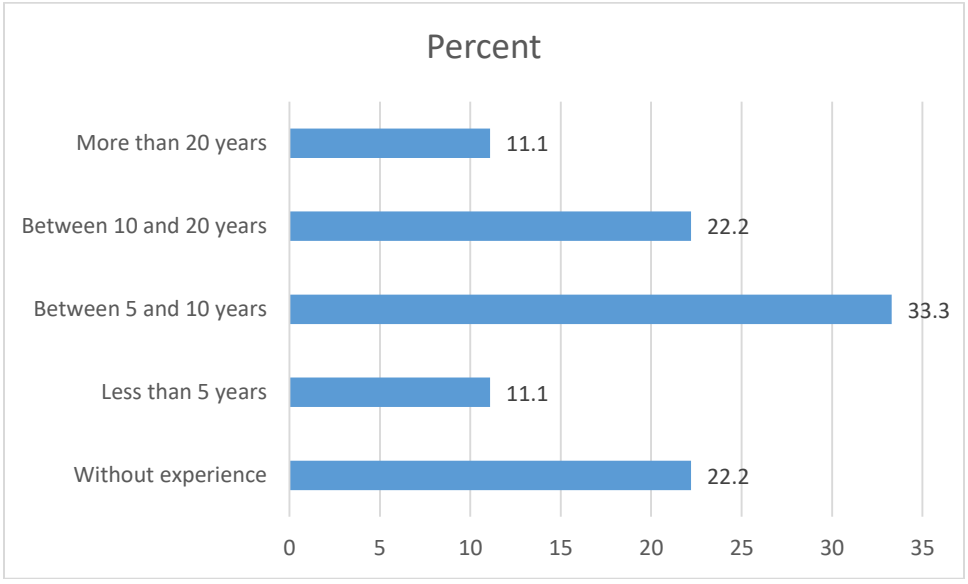

Figure 8. Percentage of each group with specific professional experience

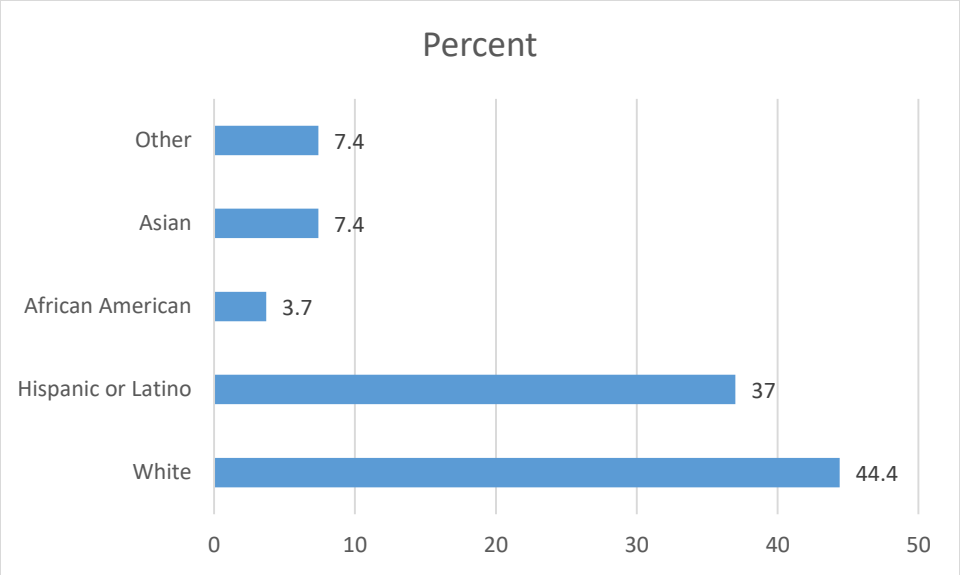

Figure 9. Percentage of each ethnicity in the experiment group

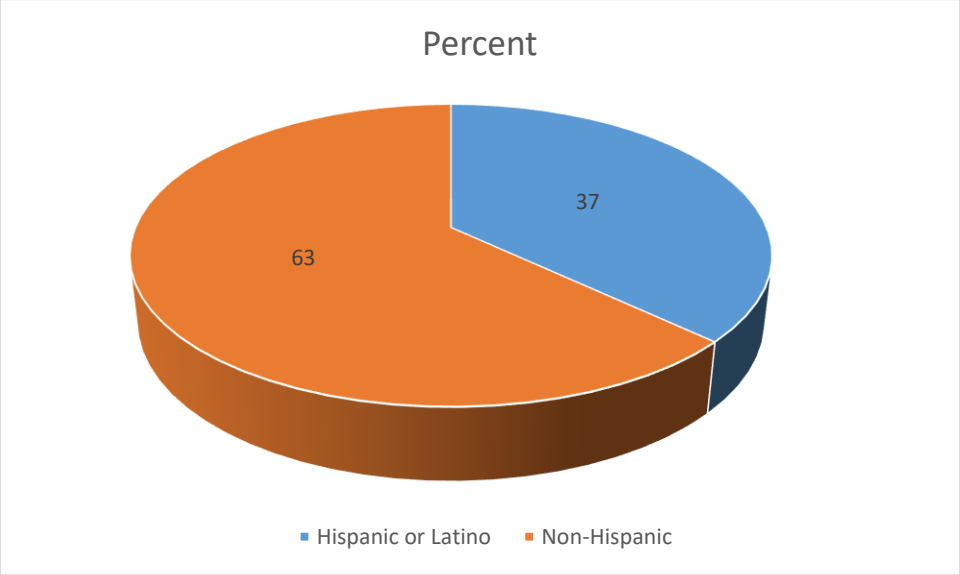

Figure 10. Percentage of Hispanic and non-Hispanic participants in the experiment group

For the experiment group, round two was broken into three sections: demographic information, rating the retention factors by importance using a five-point Likert-type scale, and ranking factors impacting Hispanic student retention (allocating 1 to the most important and 12 to the least important factor).

A majority of participants (77.8%) stated financial aid as being very important. Only 3.7% reported financial aid as having no importance in their opinion (Figure 12).

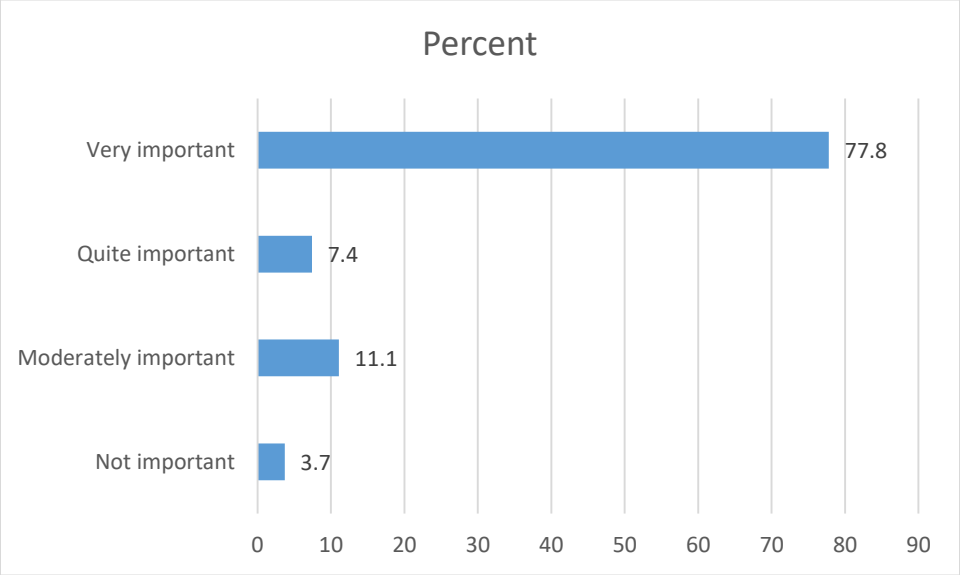

Figure 11. Financial aid

More than half the participants (55.5%) reported that construction-related student organizations are either quite important or very important. The cumulative percentage of responses shows that only 11.1% felt that such organizations have either no importance or little importance (Figure 13).

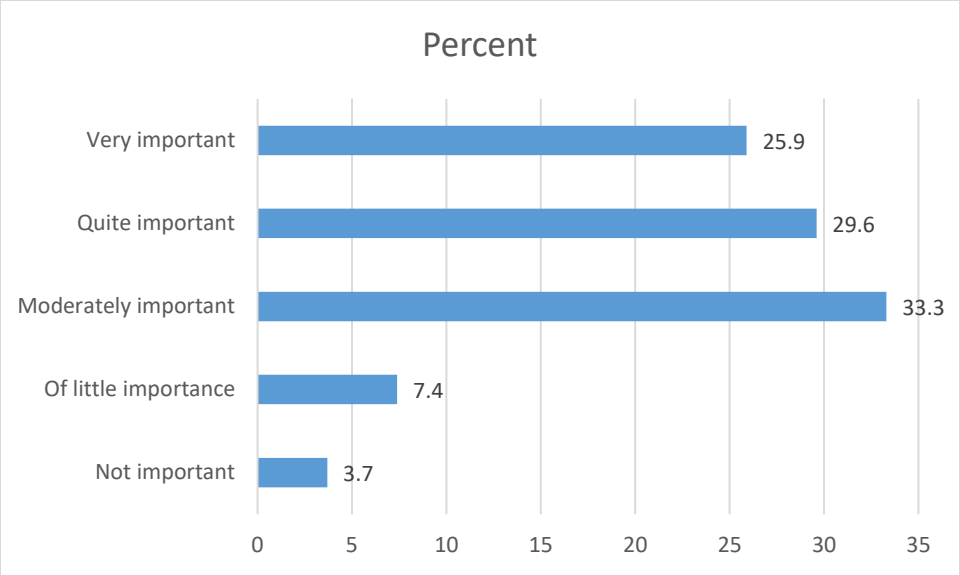

Figure 12. Construction-related student organizations

A majority of participants (74%) reported tutorial services as being either quite important or very important in their opinion. Only 3.7% felt that such services have no importance (Figure 14).

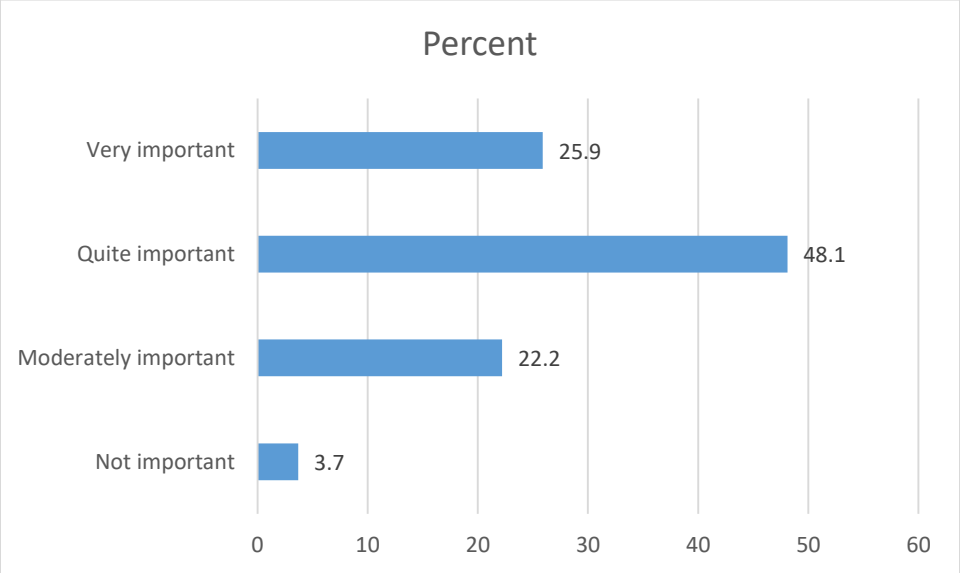

Figure 13. Tutorial services

A majority of participants (85.1%) reported feeling that academic advising is either quite important or very important. Only 3.7% stated that it is of little importance in their opinion (Figure 15).

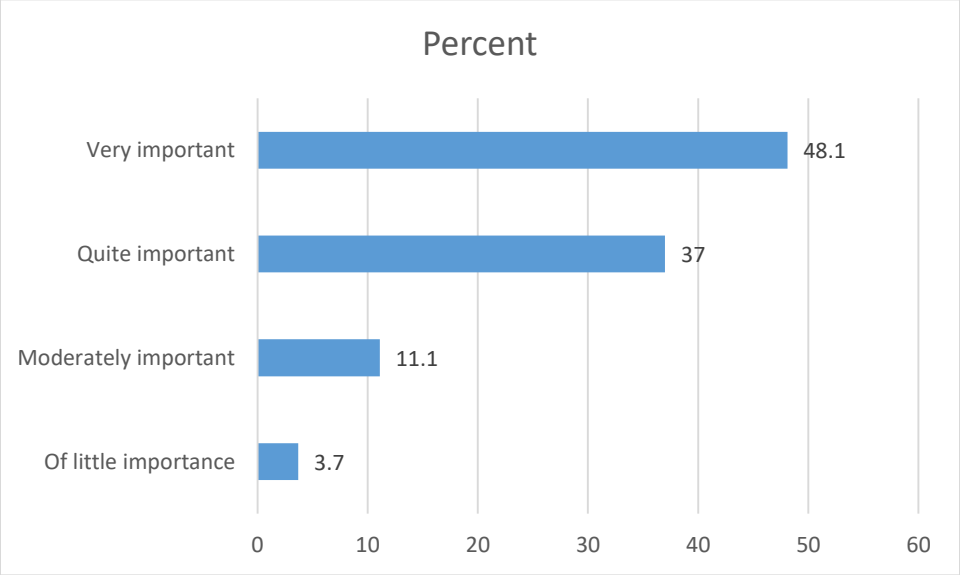

Figure 14. Academic advising

A majority of participants (88.9%) stated that career development programs are either quite important or very important in their opinion. Only 3.7% reported feeling that such programs are of little importance (Figure 16).

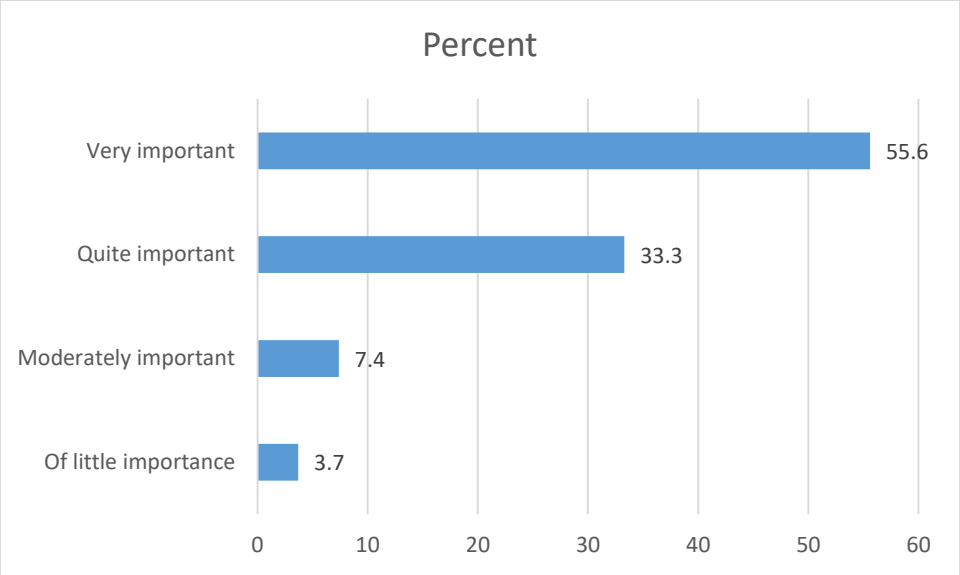

Figure 15. Career development programs

About half the participants (55.5%) stated that academic workshops are either quite important or very important in their opinion. Only 11.1% reported feeling that such workshops have little importance (Figure 17).

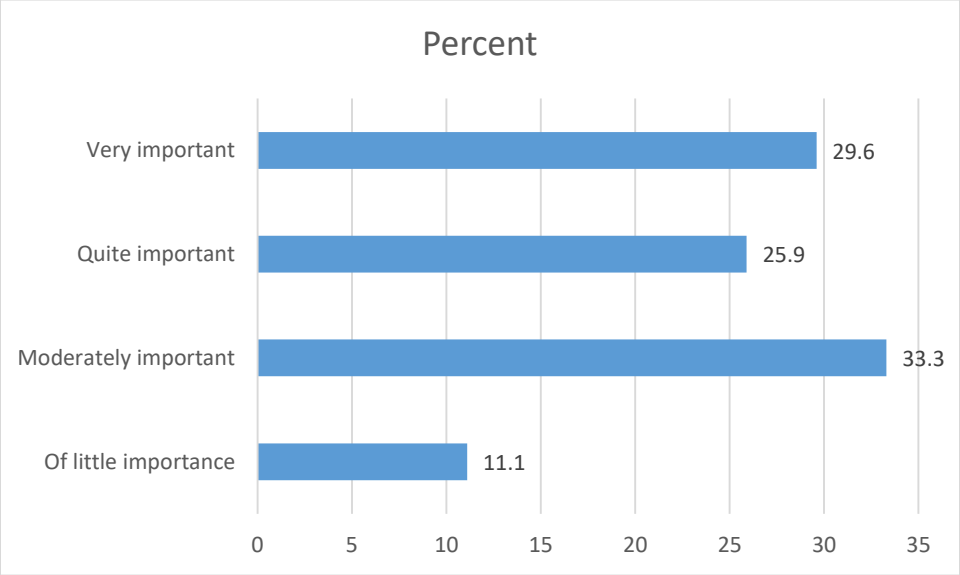

Figure 16. Academic workshops

A majority of participants (77.7%) reported that construction-oriented learning communities are either quite important or very important in their opinion. Only 18.5% participants stated feeling that such communities have either no importance or little importance (Figure 18).

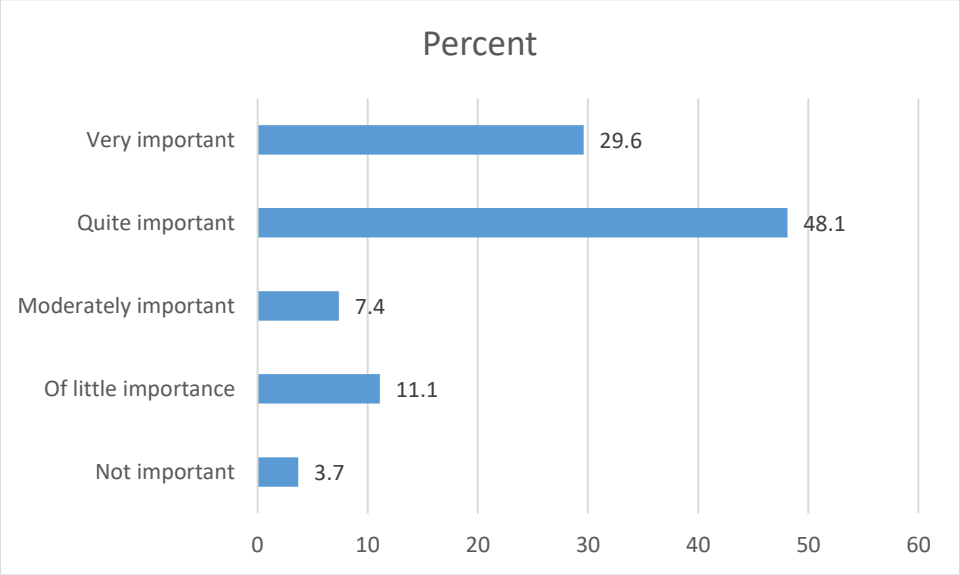

Figure 17. Construction-oriented learning communities

Over half the participants (59.2%) stated feeling that undergraduate research experience is either quite important or very important. One-third (33.3%) reported that, in their opinion, such experience is of either no importance or little importance (Figure 19).

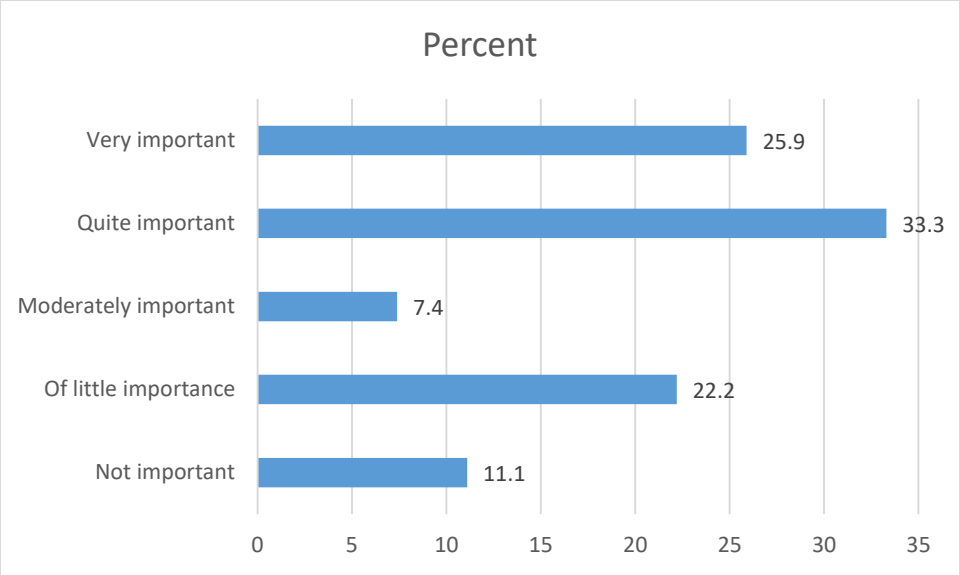

Figure 18. Undergraduate research experience

A little over half the participants (51.8%) stated that extracurricular activities are either quite important or very important. One-third (33.3%) reported that, in their opinion, such activities are of either no importance or little importance (Figure 20).

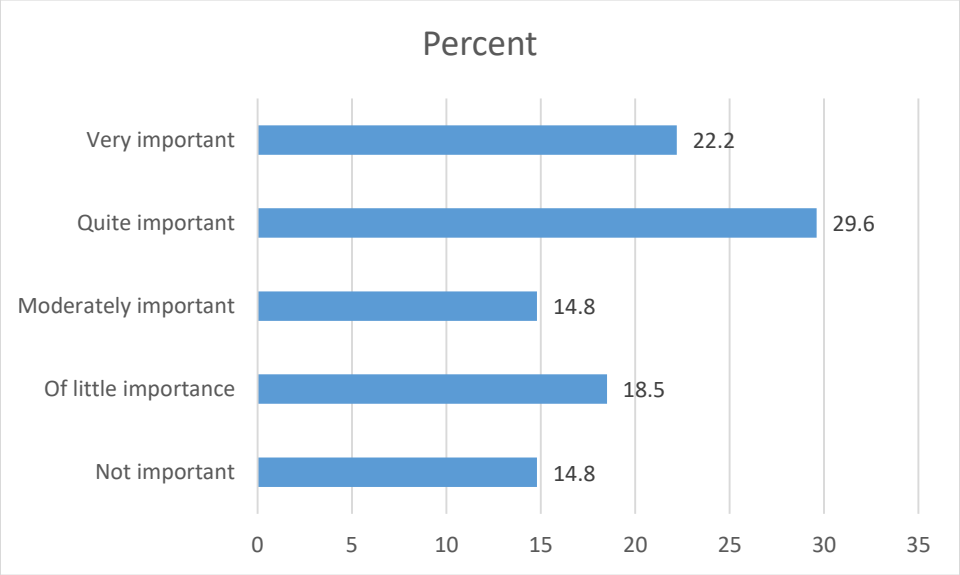

Figure 19. Extracurricular activities

All participants felt that mentoring programs have importance. A majority of all participants (96.3%) reported that mentoring programs are either quite important or very important in their opinion (Figure 21).

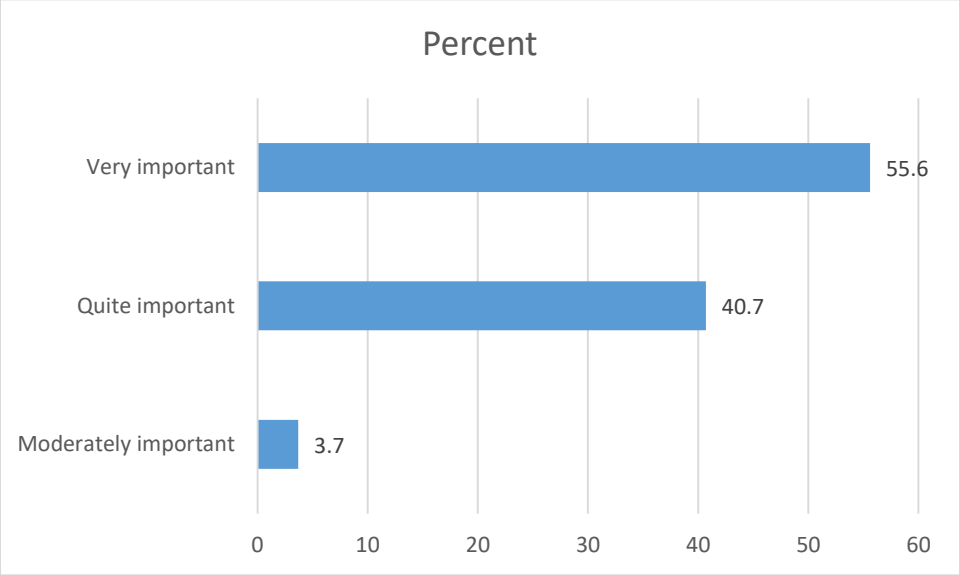

Figure 20. Mentoring programs

A majority of participants (73.1%) reported feeling that Hispanic faculty members being in a construction program is either quite important or very important. Less than one-fourth of all participants stated that such faculty members have either no importance or little importance in their opinion (Table 13).

Table 13. Hispanic Faculty Members in the Construction Program

Hispanic Faculty Members in the Construction Program		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not important	2	7.4	7.7	7.7
	Of little importance	1	3.7	3.8	11.5
	Moderately important	4	14.8	15.4	26.9
	Quite important	7	25.9	26.9	53.8
	Very important	12	44.4	46.2	100.0
	Total	26	96.3	100.0	
Missing		1	3.7		
Total		27	100.0		

A majority of participants (70.3%) reported that having Hispanic peers and students in a construction program is either quite important or very important in their opinion. Only 11.1% of participants stated that such peers and students have either no importance or little importance (Figure 22).

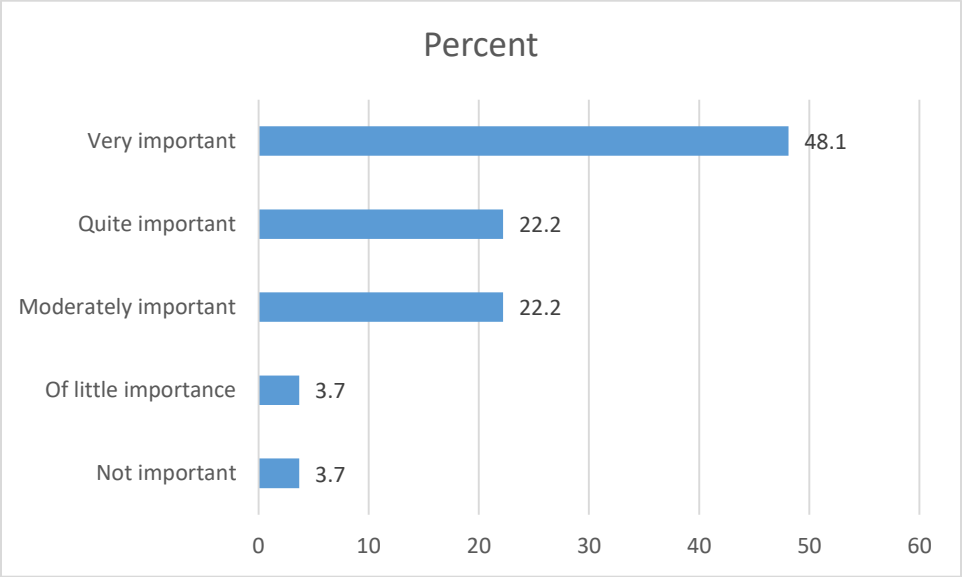

Figure 21. Hispanic peers and students in the construction program

As presented in Table 14, all factors obtained a mean greater than three, validating the literature conclusions that all of the identified factors have a positive impact on Hispanic student retention. The results of the mean calculation are presented in Table 14.

Table 14. Mean of Obtained Scores for Each Factor (Experiment Group)

Factor	Number		Mean	Std. Deviation
	Valid	Missing		
Financial Aid	27	0	4.56	0.974
Construction-Related Student Organizations	27	0	3.67	1.074
Tutorial Services	27	0	3.93	0.917
Academic Advising	27	0	4.30	0.823
Career Development Programs	27	0	4.41	0.797
Academic Workshops	27	0	3.74	1.023
Construction-Oriented Learning Communities	27	0	3.89	1.086
Undergraduate Research Experience	27	0	3.41	1.394
Extracurricular Activities	27	0	3.26	1.403
Mentoring Programs	27	0	4.52	0.580
Hispanic Faculty Members in the Construction Program	26	1	4.00	1.233
Hispanic Peers and Students in the Construction Program	27	0	4.07	1.107

Furthermore, panelist responses were compared according to the highest completed degree (PhD, Master's, Bachelor's) using the Kruskal-Wallis test. The p-values obtained through the Kruskal-Wallis test (Table 15) show statistically significant evidence (95% significance) that there is a difference in panelist ranking among the different degree completions:

- Tutorial services ($P = 0.006 < 0.05$)
- Career development programs ($P = 0.045 < 0.05$)
- Hispanic peers and students in the construction program ($P = 0.020 < 0.05$)

In other words, the results of the Kruskal-Wallis test indicate that a participant's highest completed degree correlated to rankings of the aforementioned factors.

Table 15. Kruskal-Wallis Test; Grouping Variable: Highest Completed Degree

Factor	Chi-Square	df	Asymp. Sig.	Exact Sig.
Financial Aid	0.344	2	0.842	0.836
Construction-Related Student Organizations	2.112	2	0.348	0.346
Tutorial Services	10.112	2	0.006	0.003
Academic Advising	0.518	2	0.772	0.792
Career Development Programs	6.199	2	0.045	0.043
Academic Workshops	5.755	2	0.056	0.050
Construction-Oriented Learning Communities	3.142	2	0.208	0.218
Undergraduate Research Experience	1.106	2	0.575	0.596
Extracurricular Activities	5.045	2	0.080	0.076
Mentoring Programs	0.045	2	0.978	1.000
Hispanic Faculty Members in the Construction Program	1.796	2	0.407	0.433
Hispanic Peers and Student in the Construction Program	7.865	2	0.020	0.014

The Kruskal-Wallis test was also used to compare ranking differences based on different years of teaching experience. The p-values obtained through the Kruskal-Wallis test (Table 16) indicate no statistically significant evidence ($P > 0.05$ at a 95% significance level) of a difference in rankings among participants with different periods of teaching experience.

Table 16. Kruskal-Wallis Test; Grouping Variable: Teaching Period

Factor	Chi-Square	df	Asymp. Sig.	Exact Sig.
Financial Aid	1.682	4	0.794	0.837
Construction-Related Student Organizations	1.406	4	0.843	0.860
Tutorial Services	5.559	4	0.235	0.238
Academic Advising	7.407	4	0.116	0.103
Career Development Programs	3.221	4	0.522	0.563
Academic Workshops	3.903	4	0.419	0.448
Construction-Oriented Learning Communities	2.581	4	0.630	0.676
Undergraduate Research Experience	4.436	4	0.350	0.367
Extracurricular Activities	2.827	4	0.587	0.615
Mentoring Programs	5.063	4	0.281	0.272
Hispanic Faculty Members in the Construction Program	2.150	4	0.708	0.732
Hispanic Peers and Students in the Construction Program	1.957	4	0.744	0.763

Further compared with the Kruskal-Wallis test were ranking differences among participants with different periods of working experience in the field of construction. The p-values obtained through the Kruskal-Wallis test (Table 17) indicate no statistically significant evidence

($P < 0.05$ at 95% significance level) of a difference among responses of participants with different periods of working experience in the construction field.

Table 17. Kruskal-Wallis Test - Grouping Variable: Time Working in the Construction Field

Factor	Chi-Square	df	Asymp. Sig.	Exact Sig.
Financial Aid	8.225	4	0.084	0.074
Construction-Related Student Organizations	4.770	4	0.312	0.326
Tutorial Services	6.693	4	0.153	0.143
Academic Advising	6.003	4	0.199	0.193
Career Development Programs	3.896	4	0.420	0.444
Academic Workshops	5.690	4	0.224	0.223
Construction-Oriented Learning Communities	3.247	4	0.517	0.547
Undergraduate Research Experience	7.686	4	0.104	0.087
Extracurricular Activities	0.755	4	0.944	0.954
Mentoring Programs	5.844	4	0.211	0.205
Hispanic Faculty Members in the Construction Program	5.058	4	0.281	0.289
Hispanic Peers and Students in the Construction Program	3.937	4	0.415	0.442

For samples smaller than 25 units, conclusions from an independent samples T test can be trusted if the dependent variables follow a normal distribution in the population. Because the numbers of male and female are 22 and 5, respectively, the distribution normality was checked by running a Shapiro-Wilk test. The Shapiro-Wilk test showed that responses were not approximately normally distributed for the two subgroups because at least one of the p-values in every pair was lower than 0.05 (Table 18). Hence, a nonparametric Mann-Whitney U test was used to compare differences between responses of the two subgroups. As shown in Table 19, all p-values were greater than 0.05, meaning that no statistically significant evidence existed of a difference in responses between genders.

Table 18. Tests of Normality for Different Genders (Experiment Group)

Factor	Gender	Shapiro-Wilk		
		Statistic	df	Sig.
Financial Aid	Male	0.466	21	0.000
	Female	0.552	5	0.000
Construction-Related Student Organizations	Male	0.885	21	0.018
	Female	0.552	5	0.000
Tutorial Services	Male	0.786	21	0.000
	Female	0.821	5	0.119
Academic Advising	Male	0.797	21	0.000
	Female	0.684	5	0.000
Career Development Programs	Male	0.726	21	0.000
	Female	0.833	5	0.146
Academic Workshops	Male	0.875	21	0.012
	Female	0.902	5	0.421
Construction-Oriented Learning Communities	Male	0.808	21	0.001
	Female	0.881	5	0.314
Undergraduate Research Experience	Male	0.880	21	0.015
	Female	0.833	5	0.146
Extracurricular Activities	Male	0.887	21	0.020
	Female	0.883	5	0.325
Mentoring Programs	Male	0.729	21	0.000
	Female	0.684	5	0.006
Hispanic Faculty Members in the Construction Program	Male	0.799	21	0.001
	Female	0.771	5	0.046
Hispanic Peers and Students in the Construction Program	Male	0.808	21	0.001
	Female	0.771	5	0.046

Table 19. Mann-Whitney U Test; Grouping Variable: Gender (Experiment Group)

Factor	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (Two-Tailed)
Financial Aid	54.000	307.000	−0.086	0.932
Construction-Related Student Organizations	41.000	56.000	−0.911	0.362
Tutorial Services	54.000	307.000	−0.067	0.946
Academic Advising	54.500	307.500	−0.034	0.973
Career Development Programs	42.000	57.000	−0.912	0.362
Academic Workshops	52.000	305.000	−0.195	0.845
Construction-Oriented Learning Communities	46.500	299.500	−0.572	0.568
Undergraduate Research Experience	38.500	291.500	−1.066	0.287
Extracurricular Activities	36.500	289.500	−1.184	0.236
Mentoring Programs	51.000	304.000	−0.286	0.775
Hispanic Faculty Members in the Construction Program	42.000	273.000	−0.729	0.466
Hispanic Peers and Students in the Construction Program	45.000	298.000	−0.670	0.503

Because the number of participants with construction-oriented, nonconstruction-but-education-oriented, and nonconstruction-noneducation-oriented degree areas were 20, 5, and 2, respectively, the distribution normality was checked using a Shapiro-Wilk test. The Shapiro-Wilk test showed that responses were not approximately normally distributed for the three subgroups because at least one p-value in every triple was lower than 0.05 (Table 20). Hence, a nonparametric Mann-Whitney U test was used to compare differences among responses of the three subgroups. As shown in Table 21, only the p-value of the factor "Hispanic Peers and Students in the Construction Program" was lower than 0.05 ($P = 0.046$), meaning that there was no statistically significant evidence of a difference among participant responses based on degree area except for Hispanic peers and students in the construction program.

Table 20. Tests of Normality for Different Degree Areas

Factor	Area of Degree Group	Shapiro-Wilk		
		Statistic	df	Sig.
Financial Aid	Construction-Oriented	0.521	19	0.000
	Nonconstruction-Oriented but Education-Oriented	0.552	5	0.000
Construction-Related Student Organizations	Construction-Oriented	0.886	19	0.027
	Nonconstruction-Oriented but Education-Oriented	0.881	5	0.314
Tutorial Services	Construction-Oriented	0.835	19	0.004
	Nonconstruction-Oriented but Education-Oriented	0.883	5	0.325
	Nonconstruction-Oriented and Noneducation-Oriented			
Academic Advising	Construction-Oriented	0.803	19	0.001
	Nonconstruction-Oriented but Education-Oriented	0.684	5	0.006
	Nonconstruction-Oriented and Noneducation-Oriented			
Career Development Programs	Construction-Oriented	0.764	19	0.000
	Nonconstruction-Oriented but Education-Oriented	0.684	5	0.006
Academic Workshops	Construction-Oriented	0.877	19	0.019
	Nonconstruction-Oriented but Education-Oriented	0.881	5	0.314
	Nonconstruction-Oriented and Noneducation-Oriented			
Construction-Oriented Learning Communities	Construction-Oriented	0.829	19	0.003
	Nonconstruction-Oriented but Education-Oriented	0.684	5	0.006
	Nonconstruction-Oriented and Noneducation-Oriented			
Undergraduate Research Experience	Construction-Oriented	0.879	19	0.021
	Nonconstruction-Oriented but Education-Oriented	0.552	5	0.000
	Nonconstruction-Oriented and Noneducation-Oriented			
Extracurricular Activities	Construction-Oriented	0.883	19	0.024
	Nonconstruction-Oriented but Education-Oriented	0.961	5	0.814
	Nonconstruction-Oriented and Noneducation-Oriented			
Mentoring Programs	Construction-Oriented	0.641	19	0.000
	Nonconstruction-Oriented but Education Oriented	0.684	5	0.006
	Nonconstruction-Oriented and Noneducation-Oriented			
Hispanic Faculty Members in the Construction Program	Construction-Oriented	0.792	19	0.001
	Nonconstruction-Oriented but Education-Oriented	0.684	5	0.006
	Nonconstruction-Oriented and Noneducation-Oriented			

Table 20. Tests of Normality for Different Degree Areas - Continued

Hispanic Peers and Students in the Construction Program	Construction-Oriented	0.747	19	0.000
	Nonconstruction-Oriented but Education-Oriented	0.684	5	0.006
	Nonconstruction-Oriented and Noneducation-Oriented			

Table 21. Kruskal-Wallis Test Test; Grouping Variable: Area of Degree Group

Factor	Chi-Square	df	Asymp Sig.	Exact Sig.
Financial Aid	0.750	2	0.687	0.771
Construction-Related Student Organizations	1.343	2	0.511	0.606
Tutorial Services	1.024	2	0.599	0.673
Academic Advising	0.069	2	0.966	0.995
Career Development Programs	1.623	2	0.444	0.585
Academic Workshops	0.135	2	0.935	0.982
Construction-Oriented Learning Communities	2.752	2	0.253	0.265
Undergraduate Research Experience	3.089	2	0.213	0.238
Extracurricular Activities	3.160	2	0.206	0.221
Mentoring Programs	0.586	2	0.746	0.726
Hispanic Faculty Members in the Construction Program	0.340	2	0.844	0.840
Hispanic Peers and Students in the Construction Program	6.180	2	0.046	0.026

Because the numbers of Hispanic and non-Hispanic participants were 10 and 17 respectively, the distribution normality was checked using a Shapiro-Wilk test, which showed that responses were not approximately normally distributed for the two subgroups because at least one p-value in every pair was lower than 0.05 (Table 22).

Table 22. Tests of Normality for Hispanic and Non-Hispanic Panelists (Experiment Group)

Factor	Ethnic	Shapiro-Wilk		
		Statistic	df	Sig.
Financial Aid	Hispanic or Latino	0.390	9	0.000
	Non-Hispanic	0.554	17	0.000
Construction-Related Student Organizations	Hispanic or Latino	0.889	9	0.194
	Non-Hispanic	0.891	17	0.048
Tutorial Services	Hispanic or Latino	0.838	9	0.055
	Non-Hispanic	0.814	17	0.003
Academic Advising	Hispanic or Latino	0.655	9	0.000
	Non-Hispanic	0.809	17	0.003
Career Development Programs	Hispanic or Latino	0.684	9	0.001
	Non-Hispanic	0.765	17	0.001
Academic Workshops	Hispanic or Latino	0.917	9	0.364
	Non-Hispanic	0.869	17	0.021
Construction-Oriented Learning Communities	Hispanic or Latino	0.655	9	0.000
	Non-Hispanic	0.867	17	0.020
Undergraduate Research Experience	Hispanic or Latino	0.799	9	0.020
	Non-Hispanic	0.896	17	0.058
Extracurricular Activities	Hispanic or Latino	0.826	9	0.041
	Non-Hispanic	0.857	17	0.041
Mentoring Programs	Hispanic or Latino	0.564	9	0.000
	Non-Hispanic	0.632	17	0.000
Hispanic Faculty Members in the Construction Program	Hispanic or Latino	0.617	9	0.000
	Non-Hispanic	0.855	17	0.013
Hispanic Peers and Students in the Construction Program	Hispanic or Latino	0.637	9	0.000
	Non-Hispanic	0.818	17	0.004

Hence, a nonparametric Mann-Whitney U test was run to compare response differences between the two subgroups. As shown in Table 23, the p-values of two factors were lower than 0.05:

- Construction-oriented learning communities (P = 0.022)
- Hispanic faculty members in the construction program (P = 0.047)

This means that there was no statistically significant evidence of a difference between responses of Hispanic and non-Hispanic participants except for these two factors. In other words, being Hispanic or non-Hispanic only affected how participants ranked the aforementioned factors using a five-point Likert-type scale.

Table 23. Mann-Whitney U Test; Grouping Variable: Hispanic and Non-Hispanic Panelists

Factor	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (Two-Tailed)
Financial Aid	80.500	233.500	–0.311	0.756
Construction-Related Student Organizations	68.500	221.500	–0.864	0.388
Tutorial Services	64.000	217.000	–1.136	0.256
Academic Advising	72.500	225.500	–0.686	0.493
Career Development Programs	66.500	219.500	–1.044	0.297
Academic Workshops	80.500	233.500	–0.236	0.814
Construction-Oriented Learning Communities	42.500	195.500	–2.299	0.022
Undergraduate Research Experience	56.500	209.500	–1.481	0.139
Extracurricular Activities	82.500	137.500	–0.129	0.898
Mentoring Programs	57.000	210.000	–1.611	0.107
Hispanic Faculty Members in the Construction Program	42.000	195.000	–1.983	0.047
Hispanic Peers and Students in the Construction Program	62.500	215.500	–1.213	0.225

The next question asked panelists to rank the factors impacting Hispanic student retention in construction science education programs. The average ranking for each choice of the ranking question was calculated according to the following formula. W represents the weight of ranked position, and the question has 12 choices. A sample respondent could rank in the order "Financial Aid, Academic Advising, Mentoring Programs, Tutorial Services, Hispanic Peers and Students in the Construction Program, Hispanic Faculty Members in the Construction Program, Career Development Programs, Construction-Related Student Organizations, Academic Workshops, Construction-Oriented Learning Communities, Extracurricular Activities, Undergraduate Research Experience"—weighing financial aid as 12, academic advising as 11, mentoring programs as 10, tutorial services as 9, Hispanic peers and students in the construction program as 8, Hispanic faculty members in the construction program as 7, career development programs as 6,

construction-related student organizations as 5, academic workshops as 4, construction-oriented learning communities as 3, extracurricular activities as 2, and undergraduate research experience as 1. X represents the response count for the answer choice. If three respondents rank financial aid first, then X Financial Aid is 3. "Total" refers to the number of respondents filling in the questionnaire.

According to Liu and Wu (2017), average ranking = $[X_A W_A + X_B W_B + \cdots + X_G W_G] \div Total$. The answer choice with the largest average ranking is the most preferred choice. Average ranking, presented in Table 24 and Figure 23, is as follows:

1) Financial aid
2) Academic advising
3) Mentoring programs
4) Tutorial services
5) Hispanic peers and students in the construction program
6) Hispanic faculty members in the construction program
7) Career development programs
8) Construction-related student Organizations
9) Academic workshops
10) Construction-oriented learning communities
11) Extracurricular activities
12) Undergraduate research experience

Table 24. Average Ranking by Experiment Group

Factor	N	Mean
Undergraduate Research Experience	23	3.70
Extracurricular Activities	24	3.92
Construction-Oriented Learning Communities	23	5.43
Academic Workshops	23	5.61
Construction-Related Student Organizations	23	6.13
Career Development Programs	23	6.48
Hispanic Faculty Members in the Construction Program	24	6.50
Hispanic Peers and Students in the Construction Program	25	6.72
Tutorial Services	23	6.96
Mentoring Programs	24	8.08
Academic Advising	22	8.50
Financial Aid	25	11.08

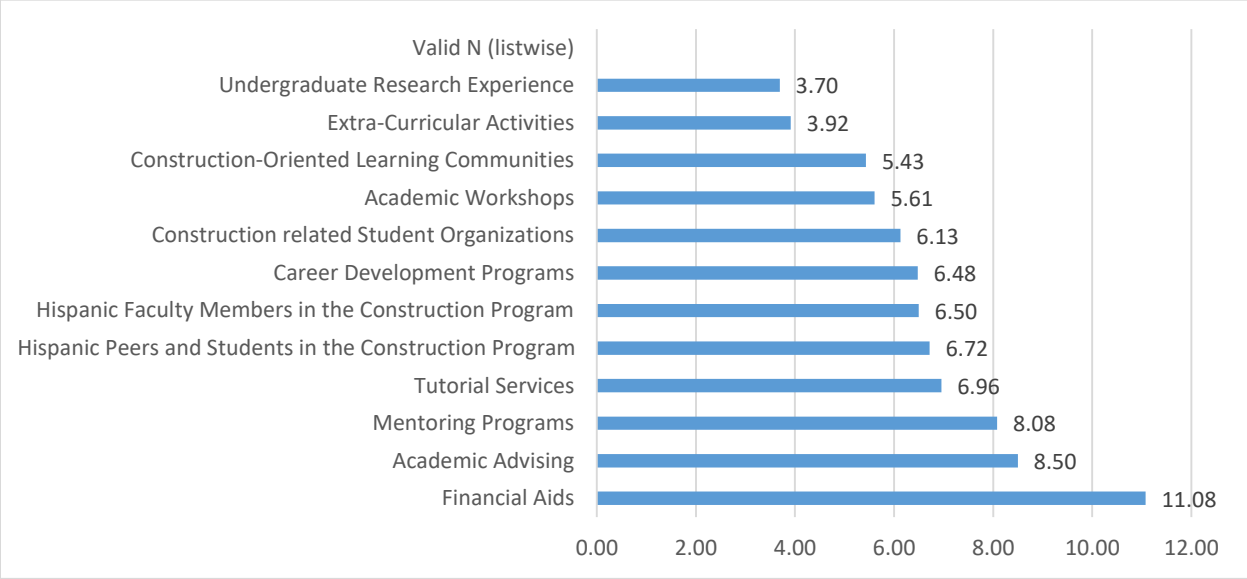

Figure 22. Ranking of Factors Impacting Hispanic Student Retention in Construction Education Programs (experiment group)

Industry Professionals (Control Group)

Of 26 panelists, 22 (88.0%) were male, three (12.0%) were female, and one chose not to report gender (Table 25). Regarding the highest completed degree, a majority of respondents (96.0%) reported completing their bachelor's degree, and only 4.0% of panelists reported completing a master's degree (Figure 24).

Table 25. Gender of Control Group

		Frequency	Valid Percent	Cumulative Percent
Valid	Male	22	88.0	88.0
	Female	3	12.0	100.0
	Total	25	100.0	
Missing		1		
Total		26		

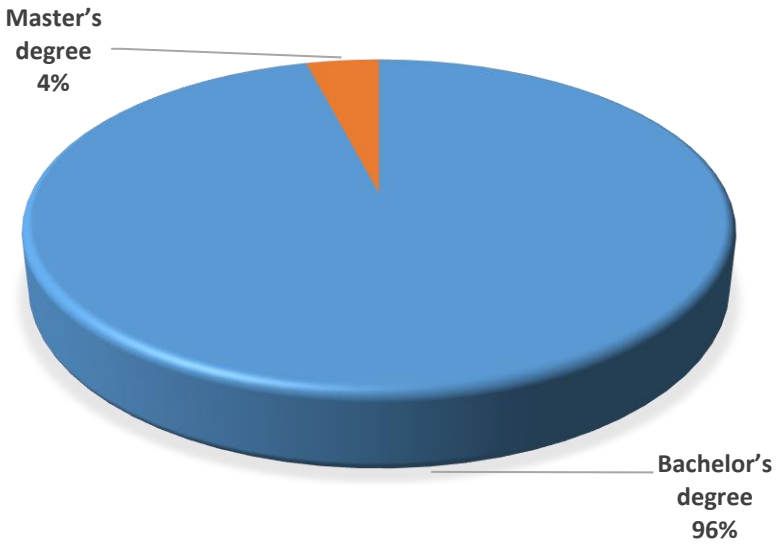

Figure 23. Percentage of highest completed degree of control group

Over half the participants (73.1%) had worked less than 15 years in the field of construction, and 15.4% had worked in the field of construction more than 25 years (Figure 25).

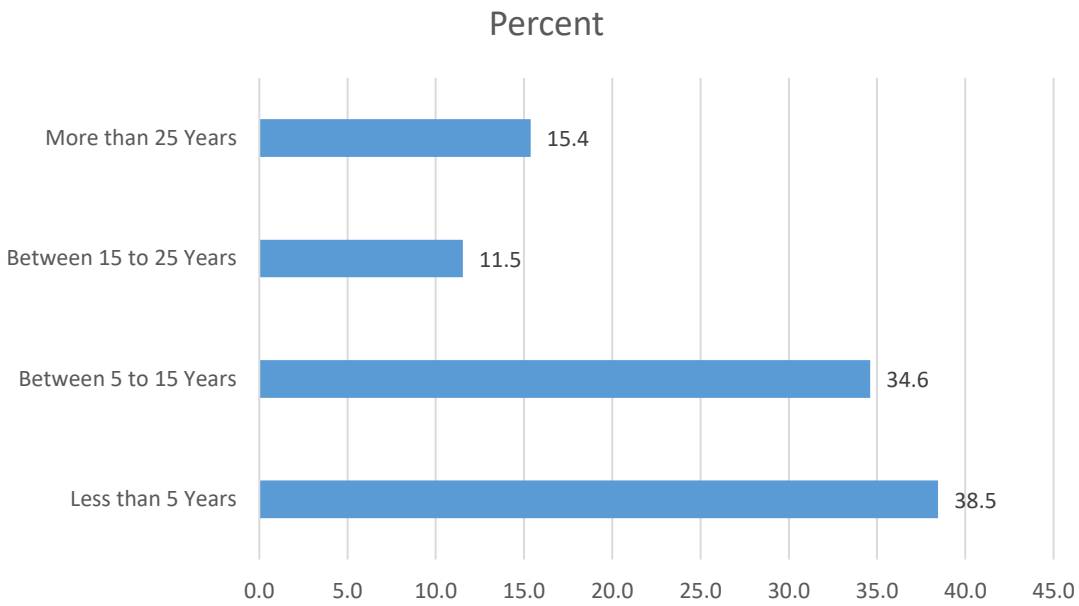

Figure 24. Percentage of each group with specific working experience

Regarding ethnicity, a majority of participants (69.2%) were either Hispanic or Latino. The rest (30.8%) were either non-Hispanic or White. In this particular section, the non-Hispanic category included only White individuals.

Only 11.5% of participants held a professional registration, and only 23.1% participants had presented at conferences. A majority of participants (92.3%) reported having written for the construction industry, but none had published a peer-reviewed journal article. No participants had written a book chapter.

For the control group, round two was broken into three sections: demographic information, rating the retention factors by importance using a five-point Likert-type scale, and ranking the factors impacting Hispanic student retention in construction science education (allocating 1 to the most important factor and 12 to the least important factor).

A majority of participants (73.1%) stated that financial aid is very important. No participants reported financial aid as having no importance or little importance in their opinion (Figure 26).

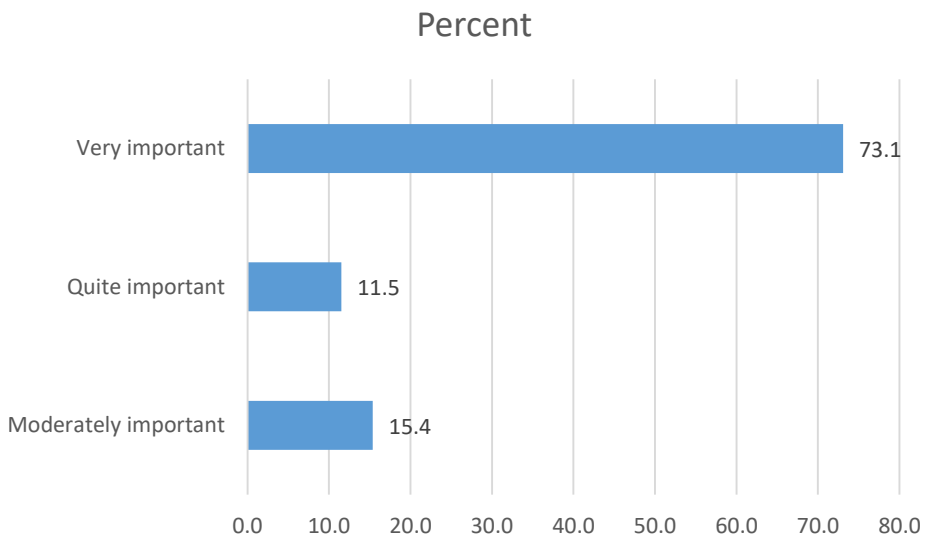

Figure 25. Financial aid importance

Nearly one-third (30.8%) of participants reported that construction-related student organizations are either quite important or very important. However, the cumulative percentage of responses shows 23% stating that such organizations have either no importance or little importance. Nearly half of all participants reported feeling that such organizations are moderately important (Figure 27).

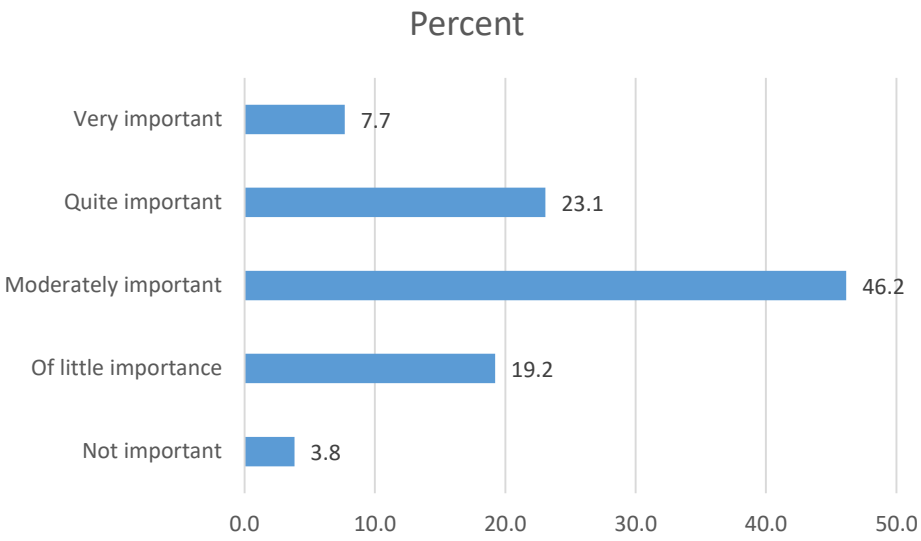

Figure 26. Importance of construction-related student organizations

More than half the participants (38.5% + 19.2% = 57.7%) reported that tutorial services are either quite important or very important in their opinion. No participants felt that such services have no importance (Figure 28).

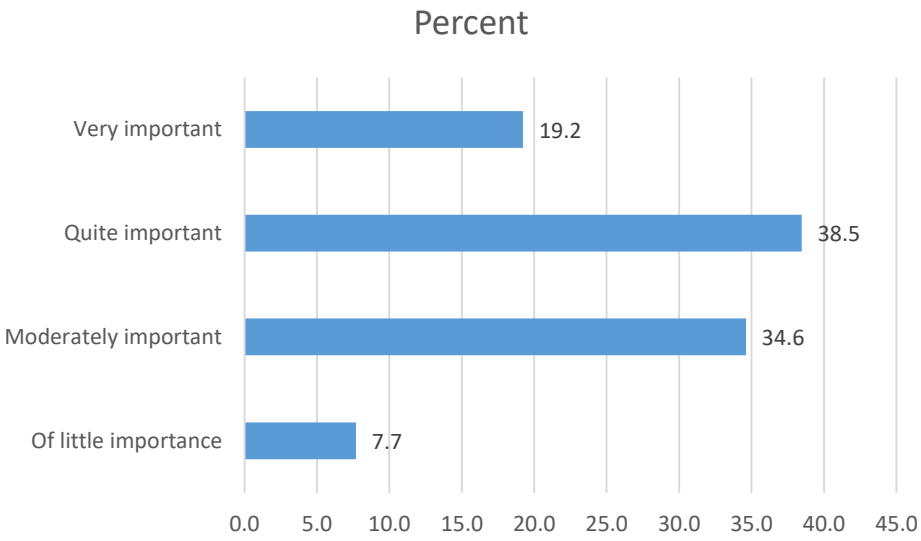

Figure 27. Importance of tutorial services

More than half the participants (69.2%) reported academic advising as being either quite important or very important in their opinion. Only 7.7% felt the academic advising is of either no importance or little importance (Figure 29).

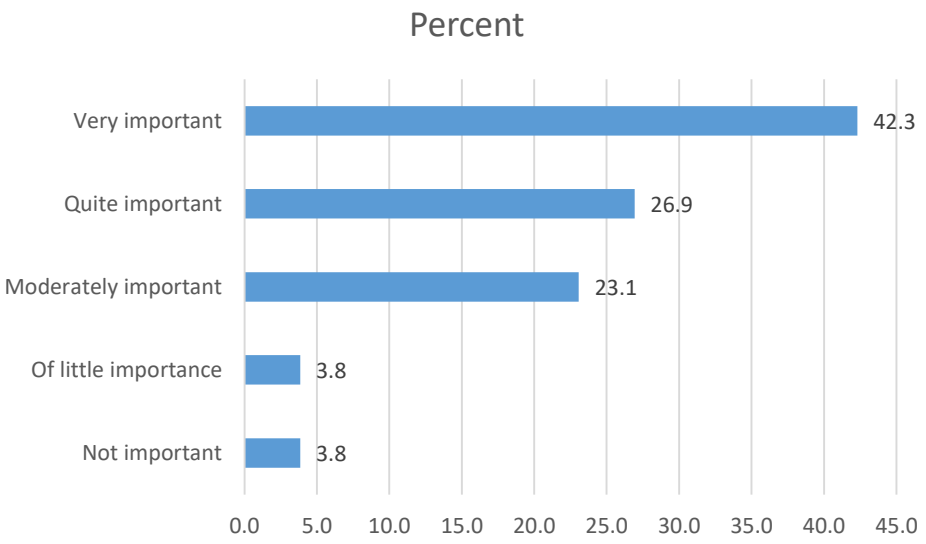

Figure 28. Importance of academic advising

All participants stated that career development programs are either quite important or very important in their opinion (Figure 30).

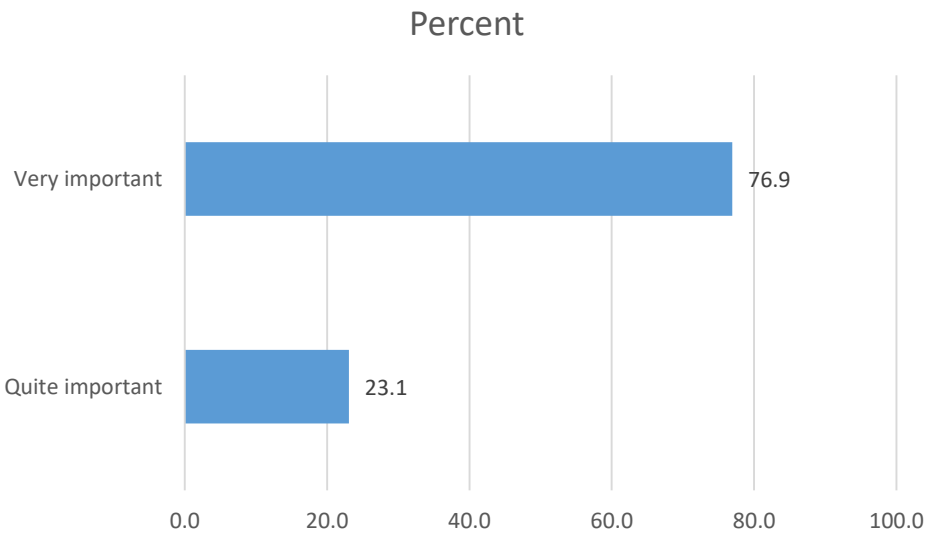

Figure 29. Importance of career development programs

Almost half (42.3%) the participants stated that academic workshops are either quite important or very important in their opinion. Only 11.5% reported feeling that such workshops have little importance (Figure 31).

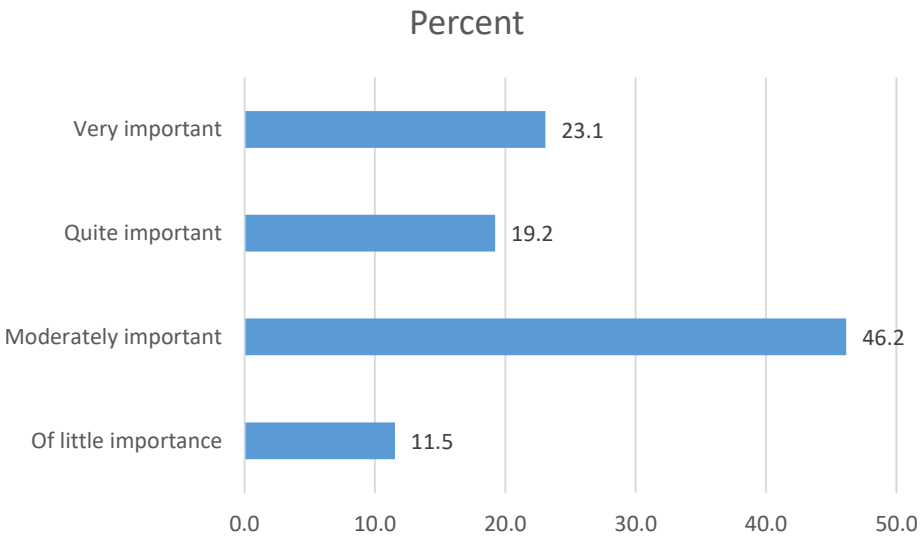

Figure 30. Importance of academic workshops

A majority of participants (76.9%) reported that construction-oriented learning communities are either quite important or very important in their opinion. Only 11.5% participants stated feeling that such communities have little importance (Figure 32).

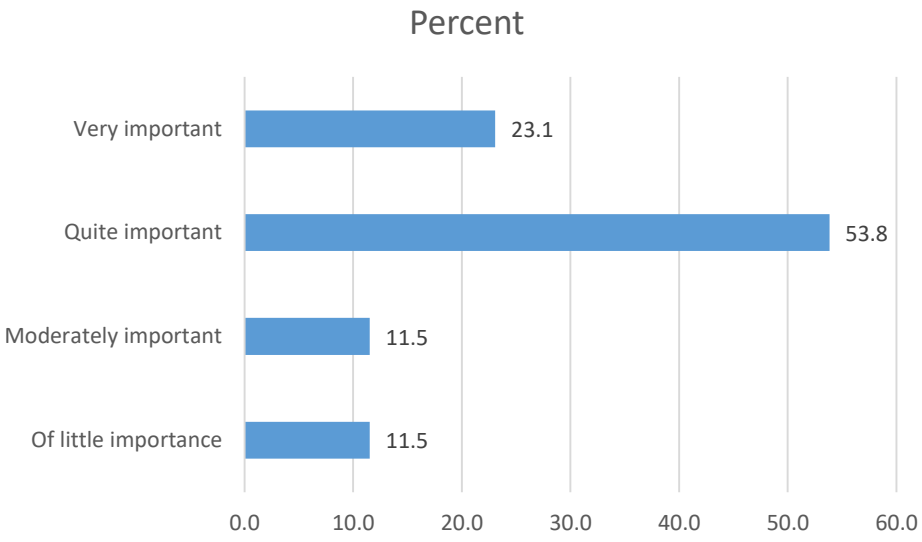

Figure 31. Importance of construction-oriented learning communities

Half the participants felt that undergraduate research experience has either no importance or little importance. Almost one-fourth (23.1%) reported that, in their opinion, such experience is moderately important (Figure 33).

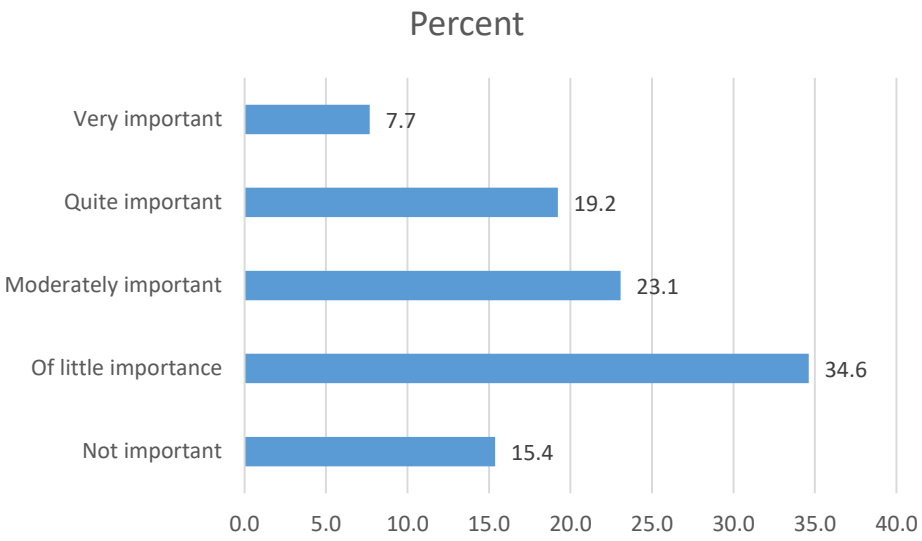

Figure 32. Undergraduate research experience importance

Half the participants stated that extracurricular activities are either quite important or very important. Almost one-third (30.8%) considered such activities as being of either no importance or little importance (Figure 34).

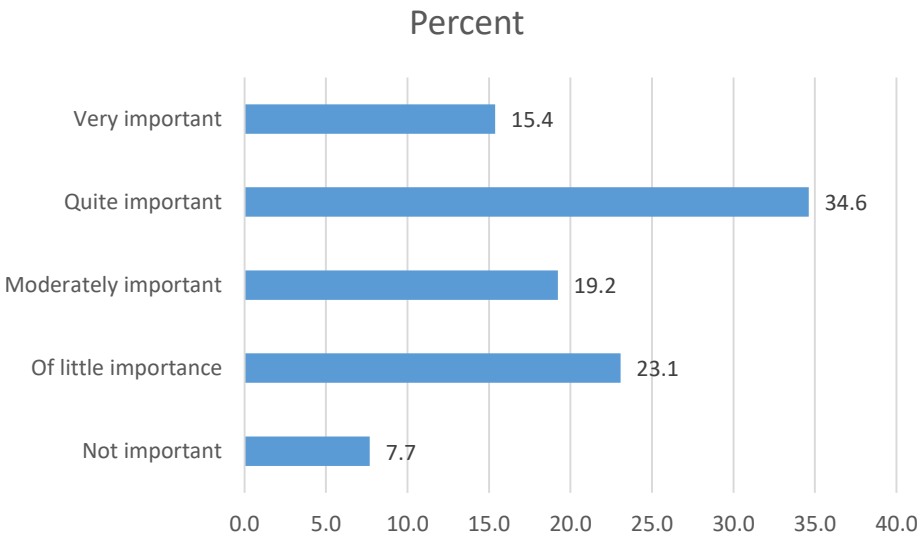

Figure 33. Importance of extracurricular activities

Half the participants stated that mentoring programs are either quite important or very important in their opinion. Only 7.7% reported feeling that mentoring programs have either no importance or little importance (Figure 35).

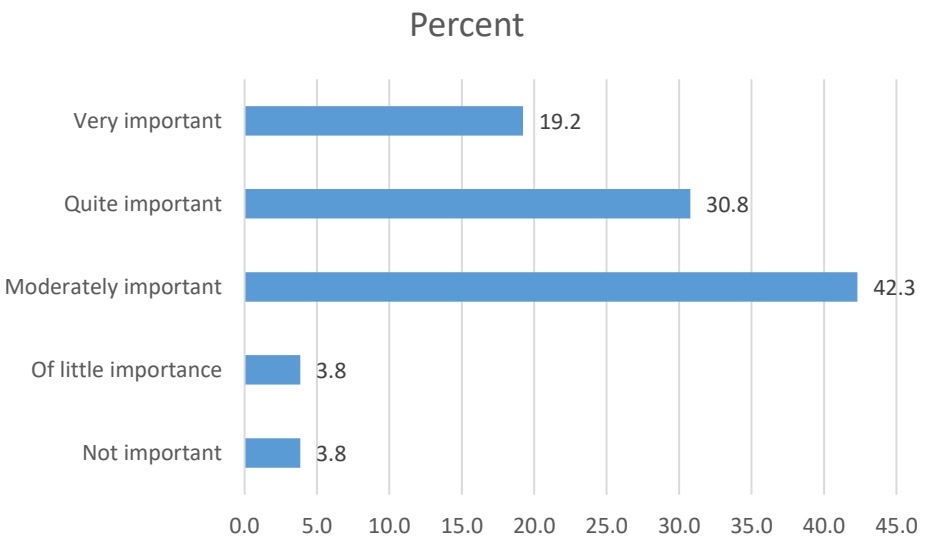

Figure 34. Importance of mentoring programs

More than half the participants (69.2%) felt that having Hispanic faculty members in the construction program is either quite important or very important. Only 15.4% stated that such faculty members have either no importance or little importance in their opinion (Figure 36).

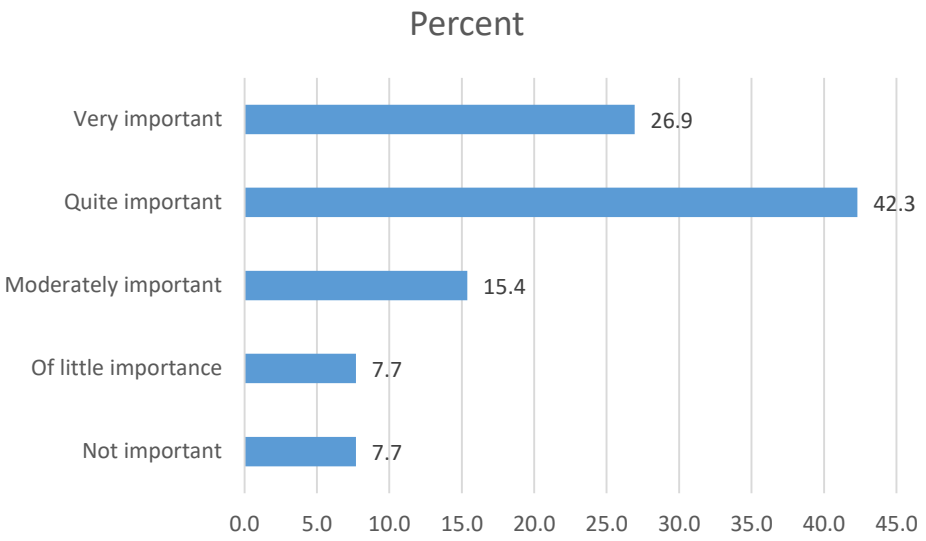

Figure 35. Importance of Hispanic faculty members in the construction program

A majority of participants (80.8%) felt that having Hispanic peers and students in the construction program is either quite important or very important. Only 11.1% of participants stated feeling that such peers and students have either no importance or little importance (Figure 37).

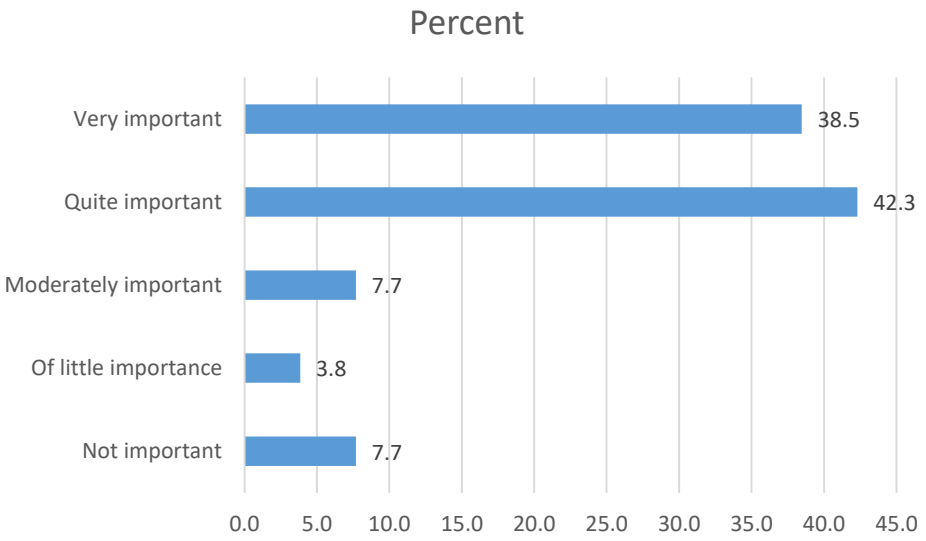

Figure 36. Importance of Hispanic peers and students in the construction program

As shown in Table 26, the mean of scores obtained for each factor is higher than three, which means that all received scores higher on average than what is considered "moderately important."

Table 26. Mean of Obtained Scores for Each Factor (Control Group)

Factor	Number		Mean	Std. Deviation
	Valid	Missing		
Financial Aid	26	0	4.58	0.758
Construction-Related Student Organizations	26	0	3.12	0.952
Tutorial Services	26	0	3.69	0.884
Academic Advising	26	0	4.00	1.095
Career Development Programs	26	0	4.77	0.430
Academic Workshops	26	0	3.54	0.989
Construction-Oriented Learning Communities	26	0	3.88	0.909
Undergraduate Research Experience	26	0	2.69	1.192
Extracurricular Activities	26	0	3.27	1.218
Mentoring Programs	26	0	3.58	0.987
Hispanic Faculty Members in the Construction Program	26	0	3.73	1.185
Hispanic Peers and Students in the Construction Program	26	0	4.00	1.166

Panelist responses were compared according to different number of years working in the field of construction by employing the Kruskal-Wallis test. The p-values obtained through the Kruskal-Wallis test (Table 27) indicate statistically significant evidence (95% significance level) of a difference in response among panelists with different years working in the field of construction:

- Academic advising ($P = 0.014 < 0.05$)
- Career development programs ($P = 0.031 < 0.05$)

Table 27. Kruskal-Wallis Test; Grouping Variable: Years Working in the Field of Construction

Factors	Chi-Square	df	Asymp. Sig.	Exact Sig.
Financial Aid	2.329	3	0.507	0.562
Construction-Related Student Organizations	3.385	3	0.336	0.348
Tutorial Services	0.888	3	0.828	0.840
Academic Advising	10.602	3	0.014	0.006
Career Development Programs	8.900	3	0.031	0.022
Academic Workshops	0.654	3	0.884	0.894
Construction-Oriented Learning Communities	3.704	3	0.295	0.304
Undergraduate Research Experience	1.710	3	0.635	0.659
Extracurricular Activities	4.169	3	0.244	0.249
Mentoring Programs	1.378	3	0.711	0.732
Hispanic Faculty Members in the Construction Program	0.884	3	0.829	0.852
Hispanic Peers and Student in the Construction Program	0.213	3	0.975	0.978

The Mann-Whitney U test was applied to compare response differences depending on highest completed degree, either bachelor's or master's. The p-values obtained through the Mann-Whitney U test (Table 28) indicate no statistically significant evidence ($P < 0.05$) of a difference in responses between these two subgroups. In other words, the highest completed degree had no effect on how the participants ranked the factors using Likert-type scale questions.

Table 28. Mann-Whitney U Test; Grouping Variable: Highest Completed Degree

Factor	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (Two-Tailed)	Exact Sig. (Two-Tailed)
Financial Aid	9.000	309.000	–0.557	0.578	1.000
Construction-Related Student Organizations	0.500	300.500	–1.708	0.088	0.120
Tutorial Services	5.500	6.500	–0.952	0.341	0.600
Academic Advising	4.000	5.000	–1.179	0.239	0.280
Career Development Programs	9.500	309.500	–0.500	0.617	1.000
Academic Workshops	8.000	308.000	–0.595	0.552	1.000
Construction-Oriented Learning Communities	11.500	12.500	–0.077	0.939	1.000
Undergraduate Research Experience	9.500	309.500	–0.357	0.721	1.000
Extracurricular Activities	4.500	5.500	–1.071	0.284	0.480
Mentoring Programs	8.500	308.500	–0.513	0.608	1.000
Hispanic Faculty Members in the Construction Program	3.000	303.000	–1.308	0.191	0.440
Hispanic Peers and Students in the Construction Program	4.500	304.500	–1.114	0.265	0.600

For samples smaller than 25 units, conclusions from an independent samples T test can be trusted if the dependent variables follow a normal distribution in the population. Because the numbers of male and female were 22 and 3, respectively, the distribution normality was checked using a Shapiro-Wilk test. The Shapiro-Wilk test showed that responses were not approximately normally distributed for the two subgroups because at least one p-value in each pair was lower than 0.05 (Table 29).

Table 29—Tests of Normality for Different Genders (Control Group)

Factor	Gender	Shapiro-Wilk		
		Statistic	df	Sig.
Financial Aid	Male	0.596	22	0.000
Construction-Related Student Organizations	Male	0.920	22	0.076
Tutorial Services	Male	0.870	22	0.008
Academic Advising	Male	0.816	22	0.001
	Female	0.750	3	0.000
Career Development Programs	Male	0.522	22	0.000
Academic Workshops	Male	0.839	22	0.002
	Female	0.750	3	0.000
Construction-Oriented Learning Communities	Male	0.761	22	0.000
	Female	1.000	3	1.000
Undergraduate Research Experience	Male	0.924	22	0.092
	Female	0.750	3	0.000
Extracurricular Activities	Male	0.915	22	0.061
	Female	0.750	3	0.000
Mentoring Programs	Male	0.886	22	0.015
	Female	0.750	3	0.000
Hispanic Faculty Members in the Construction Program	Male	0.844	22	0.003
	Female	0.750	3	0.000
Hispanic Peers and Students in the Construction Program	Male	0.751	22	0.000
	Female	0.750	3	0.000

Hence, a nonparametric Mann-Whitney U test was used to compare differences between responses of the two subgroups. As shown in Table 30, all p-values were greater than 0.05 except for the factor "Extracurricular Activities" ($p = 0.028 < 0.05$), meaning that there existed statistically significant evidence of a difference between genders in ranking only extracurricular activities.

Table 30. Mann-Whitney U Test; Grouping Variable: Gender (Control Group)

Factor	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (Two-Tailed)	Exact Sig. (Two-Tailed)
Financial Aid	24.000	277.000	–1.007	0.314	0.554
Construction-Related Student Organizations	28.500	34.500	–0.403	0.687	0.816
Tutorial Services	13.500	19.500	–1.723	0.085	0.104
Academic Advising	30.000	283.000	–0.267	0.790	0.976
Career Development Programs	25.500	278.500	–0.905	0.366	0.587
Academic Workshops	28.000	34.000	–0.449	0.654	0.741
Construction-Oriented Learning Communities	13.000	19.000	–1.859	0.063	0.068
Undergraduate Research Experience	13.500	19.500	–1.680	0.093	0.115
Extracurricular Activities	7.500	260.500	–2.197	0.028	0.038
Mentoring Programs	25.500	31.500	–0.662	0.508	0.700
Hispanic Faculty Members in the Construction Program	21.500	274.500	–1.008	0.314	0.304
Hispanic Peers and Students in the Construction Program	26.500	279.500	–0.582	0.561	0.615

Because the number of Hispanic and non-Hispanic participants were 18 and 8, respectively, the distribution normality was checked by running a Shapiro-Wilk test. The Shapiro-Wilk test showed that responses were not approximately normally distributed for the two subgroups because at least one p-value in each pair was lower than 0.05 (Table 31). Hence, a nonparametric Mann-Whitney U test was used to compare differences between responses of the two subgroups. As shown in Table 32, the p-values of all factors were greater than 0.05, meaning that there was no statistically significant evidence of difference in responses between Hispanic and non-Hispanic participants while ranking the factors. In other words, identifying as Hispanic or non-Hispanic had no correlation to how participants ranked the factors using a five-point Likert-type scale.

Table 31. Tests of Normality for Hispanic and Non-Hispanic Panelists (Control Group)

Factor	Ethnicity	Shapiro-Wilk		
		Statistic	df	Sig.
Financial Aid	Hispanic or Latino	0.475	18	0.000
	Non-Hispanic	0.736	8	0.006
Construction-Related Student Organizations	Hispanic or Latino	0.830	18	0.004
	Non-Hispanic	0.815	8	0.041
Tutorial Services	Hispanic or Latino	0.864	18	0.014
	Non-Hispanic	0.872	8	0.156
Academic Advising	Hispanic or Latino	0.782	18	0.001
	Non-Hispanic	0.858	8	0.114
Career Development Programs	Hispanic or Latino	0.520	18	0.000
	Non-Hispanic	0.566	8	0.000
Academic Workshops	Hispanic or Latino	0.760	18	0.000
	Non-Hispanic	0.794	8	0.025
Construction-Oriented Learning Communities	Hispanic or Latino	0.796	18	0.001
	Non-Hispanic	0.860	8	0.120
Undergraduate Research Experience	Hispanic or Latino	0.914	18	0.101
	Non-Hispanic	0.809	8	0.036
Extracurricular Activities	Hispanic or Latino	0.875	18	0.022
	Non-Hispanic	0.920	8	0.428
Mentoring Programs	Hispanic or Latino	0.871	18	0.019
	Non-Hispanic	0.892	8	0.246
Hispanic Faculty Members in the Construction Program	Hispanic or Latino	0.812	18	0.002
	Non-Hispanic	0.938	8	0.592
Hispanic Peers and Students in the Construction Program	Hispanic or Latino	0.737	18	0.000
	Non-Hispanic	0.758	8	0.010

Table 32. Mann-Whitney U Test; Grouping Variable: Ethnicity

Factor	Mann-Whitney U	Wilcoxon W	Z	Asymp. Sig. (Two-Tailed)	Exact Sig. (Two-Tailed)
Financial Aid	45.500	81.500	–1.892	0.058	0.094
Construction-Related Student Organizations	61.000	97.000	–0.650	0.515	0.518
Tutorial Services	57.500	228.500	–0.851	0.395	0.387
Academic Advising	57.500	93.500	–0.852	0.394	0.412
Career Development Programs	70.000	106.000	–0.152	0.879	1.000
Academic Workshops	45.500	81.500	–1.568	0.117	0.123
Construction-Oriented Learning Communities	62.000	233.000	–0.610	0.542	0.623
Undergraduate Research Experience	40.500	76.500	–1.808	0.071	0.073
Extracurricular Activities	49.500	85.500	–1.292	0.196	0.224
Mentoring Programs	56.000	92.000	–0.943	0.346	0.386
Hispanic Faculty Members in the Construction Program	47.000	83.000	–1.463	0.144	0.152
Hispanic Peers and Students in the Construction Program	46.500	82.500	–1.521	0.128	0.130

The next question asked panelists to rank the factors impacting Hispanic student retention in construction science education programs. The average ranking, presented in Tables 33 and Figure 38, is as follows:

1) Financial aid
2) Career development programs
3) Construction-related student organizations
4) Tutorial Services
5) Academic advising
6) Construction-oriented learning communities
7) Academic workshops
8) Extracurricular activities
9) Hispanic peers and students in the construction program
10) Hispanic faculty members in the construction program
11) Undergraduate research experience
12) Mentoring programs

Table 33. Average Ranking by Industry Professionals

Factor	N	Mean
Financial Aid	23	9.91
Construction-Related Student Organizations	23	7.26
Tutorial Services	21	6.71
Academic Advising	22	6.68
Career Development Programs	23	9.43
Academic Workshops	23	6.04
Construction-Oriented Learning Communities	23	6.48
Undergraduate Research Experience	24	5.21
Extracurricular Activities	24	5.67
Mentoring Programs	21	4.71
Hispanic Faculty Members in the Construction Program	24	5.33
Hispanic Peers and Students in the Construction Program	24	5.42

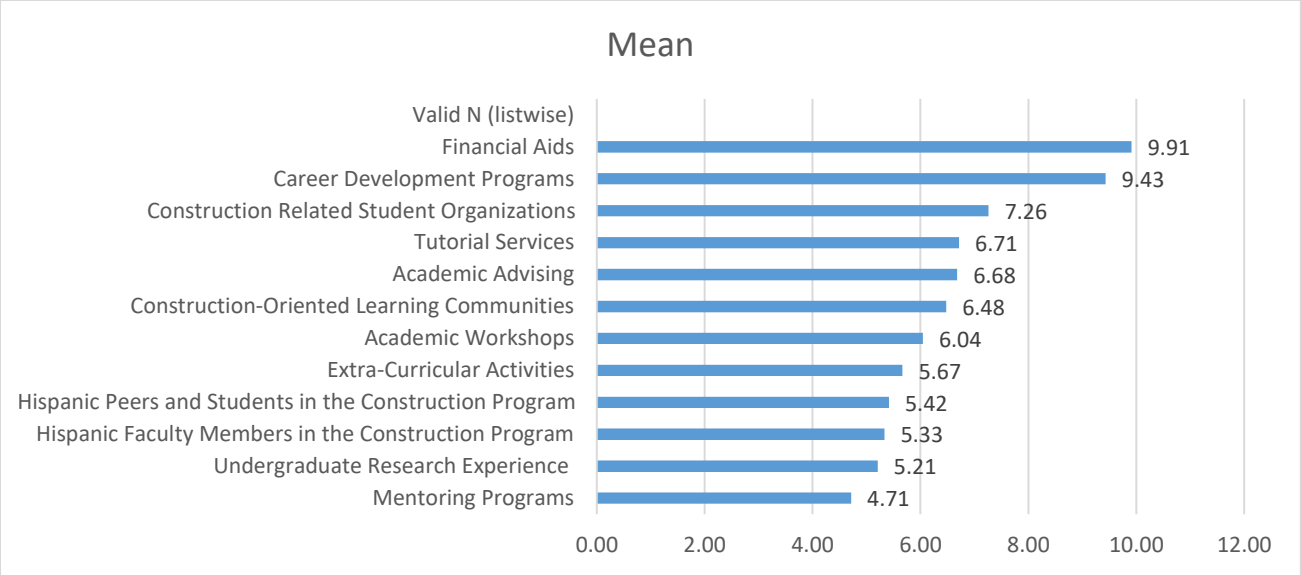

Figure 37. Ranking of factors impacting Hispanic student retention in construction education programs (control group)

Data Analysis—Round 3

This round provided academic expert (experiment group) Delphi panelists the opportunity to reconsider the scores they provided in round two. As described in the methodology section, the survey in this round included only one ranking order question comprising eight of the most important retention factors from round two as follows:

1) Financial aid
2) Academic advising
3) Mentoring programs
4) Tutorial services
5) Hispanic peers and students in the construction program
6) Hispanic faculty members in the construction program
7) Career development programs
8) Construction-related student organizations

Academic Experts (Experiment Group) Results

In this round, the academic expert panelists (experiment group) reached consensus about the level of importance of the factors impacting Hispanic student retention in undergraduate construction education (Figure 39). As shown in Table 34, the standard-deviation-to-mean ratio of all factors was less than 30%, so it can be inferred that all respondents came to agreement on the retention factor rankings.

Table 34. Standard-Deviation-to-Mean Ratio for Academic Experts (Experiment Group)

Factor	N	Mean	Std. Deviation	(Std. Deviation / Mean) × 100	Consensus Percent
Financial Aid	19	11.32	1.455	12.85% < 30%	87.15%
Academic Advising	18	10.50	0.786	7.49% < 30%	92.51%
Mentoring Programs	19	10.37	1.571	15.15% < 30%	84.85%
Tutorial Services	19	8.00	1.202	15.03% < 30%	84.97%
Hispanic Peers and Students in the Construction Program	19	7.68	1.157	15.07% < 30%	84.93%
Career Development Programs	19	7.42	1.895	25.54% < 30%	74.46%
Hispanic Faculty Members in the Construction Program	19	7.21	1.512	20.97% < 30%	79.03%
Construction-Related Student Organizations	19	5.63	1.342	23.84% < 30%	76.16%

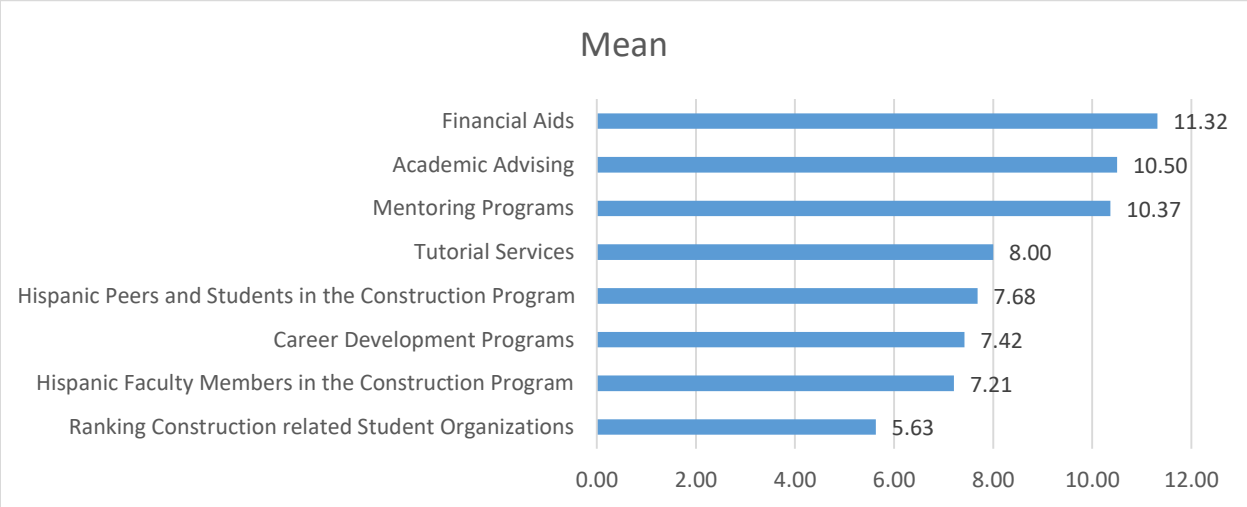

Figure 38. Result of ranking by academic experts (experiment group)

The standard-deviation-to-mean ratio of retention factors was calculated separately for Hispanic and non-Hispanic expert panelists. It was found that all ratios were less than 30% for both groups, meaning that all respondents in those groups agreed on the retention factor rankings (Table 35, Table 36, Figure 40, and Figure 41).

Table 35. Standard Deviation to Mean Ratio of Retention Factors for Hispanic Expert Panelists

Factor	N	Mean	Std. Deviation	(Std. Deviation / Mean) × 100	Consensus Percent
Financial Aid	8	11.25	0.886	7.88% < 30%	92.12%
Mentoring Programs	8	11.00	1.069	9.72% < 30%	90.28%
Academic Advising	8	10.38	0.916	8.82% < 30%	91.18%
Tutorial Services	8	7.88	1.126	14.29% < 30%	85.71%
Hispanic Faculty Members in the Construction Program	8	7.63	2.066	27.08% < 30%	72.92%
Career Development Programs	8	7.25	1.488	20.52% < 30%	79.48%
Hispanic Peers and Students in the Construction Program	8	7.13	1.126	15.79% < 30%	84.21%
Construction-Related Student Organizations	8	5.50	0.926	16.84% < 30%	83.16%

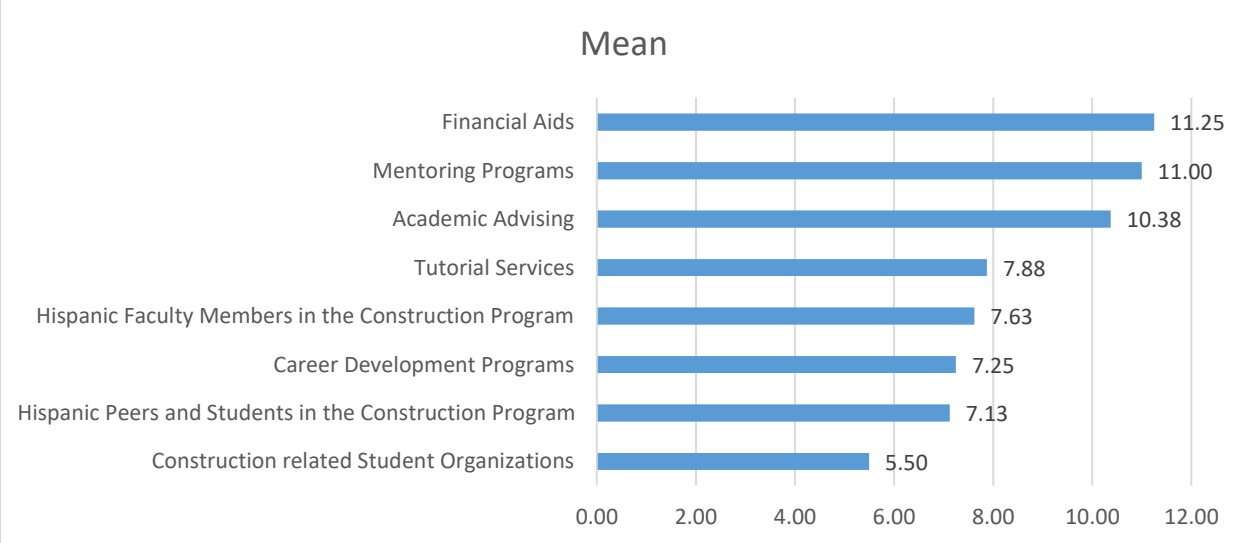

Figure 39. Mean of retention factors for Hispanic expert panelists

Table 36. Standard Deviation to Mean Ratio of Retention Factors for Non-Hispanic Expert Panelists

Factors	N	Mean	Std. Deviation	(Std. Deviation / Mean) ×100	Consensus Percent
Financial Aid	11	11.36	1.804	15.88% < 30%	84.12%
Academic Advising	10	10.60	0.699	6.59% < 30%	93.41%
Mentoring Programs	11	9.91	1.758	17.74% < 30%	82.26%
Hispanic Peers and Students in the Construction Program	11	8.09	1.044	12.90% < 30%	87.10%
Tutorial Services	11	8.09	1.300	16.07% < 30%	83.93%
Career Development Programs	11	7.55	2.207	29.23% < 30%	70.77%
Hispanic Faculty Members in the Construction Program	11	6.91	0.944	13.66% < 30%	86.34%
Construction-Related Student Organizations	11	5.73	1.618	28.24% < 30%	71.76%

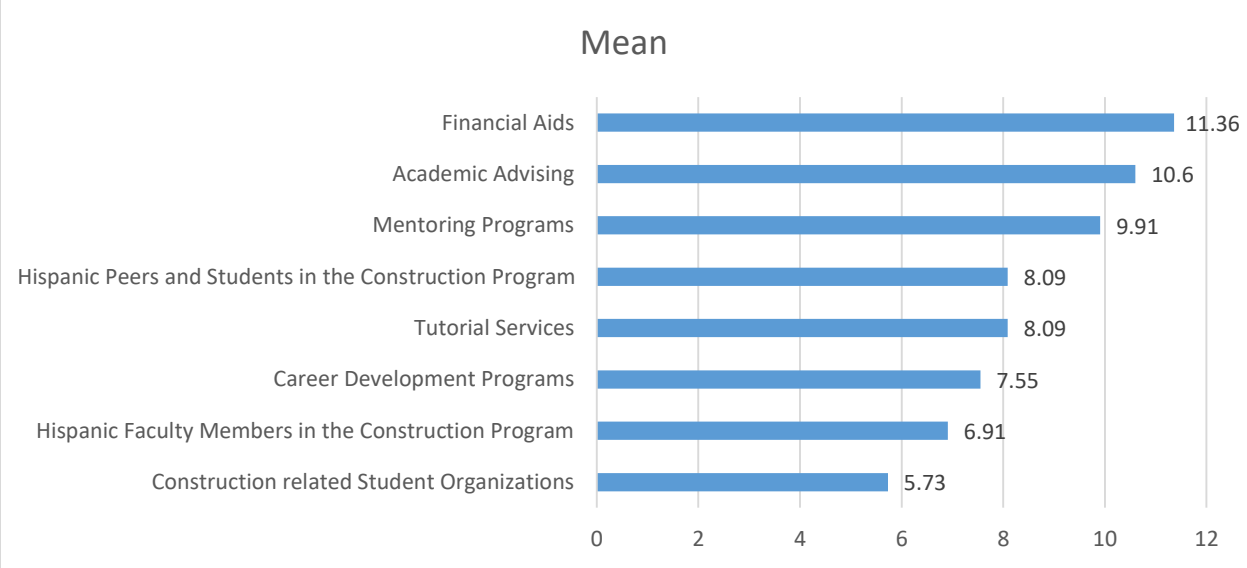

Figure 40. Mean of retention factors for non-Hispanic expert panelists

By comparing the results from Hispanic and non-Hispanic academic expert panelists with the results from all academic experts, the following can be inferred:

- Financial aid, academic advising, and mentoring programs were revealed as the most important factors among all groups.

- While all academic experts (both Hispanics and non-Hispanics) ranked financial aid, academic advising, and mentoring programs first, second, and third, respectively, Hispanic expert panelists ranked mentoring programs above academic advising.
- While all academic experts (both Hispanics and non-Hispanics) ranked tutorial services and Hispanic peers and students in the construction program fourth and fifth, respectively, non-Hispanic expert panelists ranked Hispanic peers and students in the construction program above tutorial services.
- The ranking for construction-related student organizations was consistent among all academic experts (both Hispanics and non-Hispanics) as the least important factor on the list.

As with academic experts (experiment group), industry professionals (control group) were provided the opportunity to reconsider the scores they provided in round two. The survey in this round included only one ranking order question comprising eight of the most important retention factors from round two as follows:

1) Financial aid
2) Career development programs
3) Tutorial services
4) Construction-related student organizations
5) Academic advising
6) Construction-oriented Learning communities
7) Academic workshops
8) Extracurricular activities

In this round, in contrast with the academic experts, the industry panelists did not reach consensus about the level of importance of the factors impacting Hispanic student retention undergraduate construction education. As shown in Table 37 and Figure 42, the standard-deviation-to-mean ratio of all the factors except extracurricular activities was more than 30%, so it can be concluded that all respondents agreed on the ranking of the first seven retention factors.

Table 37. Standard Deviation to Mean Ratio of Retention Factors for Industry Panelists

Factor	N	Mean	Std. Deviation	(Std. Deviation / Mean) × 100	Consensus Percent
Financial Aid	16	11.94	0.250	2.09% < 30%	97.91%
Career Development Programs	16	10.31	1.138	11.04% < 30%	88.96%
Tutorial Services	16	8.81	0.750	8.51% < 30%	91.49%
Construction-Related Student Organizations	16	8.63	1.784	20.67% < 30%	79.33%
Academic Advising	16	8.38	1.586	18.93% < 30%	81.07%
Construction-Oriented Learning Communities	16	7.31	1.493	20.42% < 30%	79.58%
Academic Workshops	16	7.00	1.713	24.47% < 30%	75.53%
Extracurricular Activities	16	5.63	1.746	31.01% > 30%	68.99%

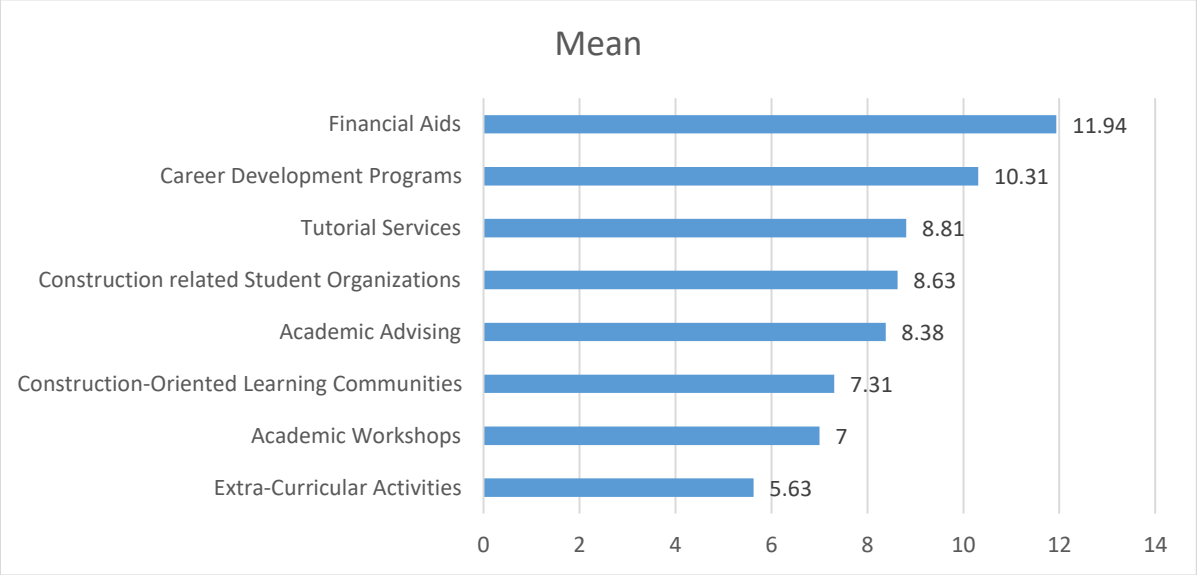

Figure 41. Mean of retention factors for industry panelists

The standard-deviation-to-mean ratio of the retention factors were calculated separately for Hispanic and non-Hispanic industry professionals. All ratios were found to be less than 30% for the Hispanic group except for extracurricular activities, meaning that all respondents in the Hispanic group agreed on the ranking of the first seven retention factors (Table 38 and Figure 43). The ratio of the financial aid factor indicates that all Hispanic panelists agreed completely about this factor. Regarding the non-Hispanic group, the ratios for five factors—construction-oriented learning communities, financial aid, academic advising, career development programs, and tutorial services—were less than 30%, meaning that respondents in the non-Hispanic group reached consensus about the ranking for five of eight retention factors (Table 39 and Figure 44). However, the ratios for extracurricular activities, academic workshops, and construction-related student organizations were slightly more than 30% (36.47%, 31.50%, and 30.22% respectively), which can be attributed to the fact that panelists in this group did not reach consensus about the three aforementioned factors.

Table 38. Standard Deviation to Mean Ratio of Retention Factors for Hispanic Industry Panelists

Factor	N	Mean	Std. Deviation	(Std. Deviation / Mean) × 100	Consensus Percent
Financial Aid	13	12.00	0.000	0.00% < 30%	100%
Career Development Programs	13	10.54	0.776	7.36% < 30%	92.64%
Tutorial Services	13	8.77	0.725	8.27% < 30%	91.73%
Construction-Related Student Organizations	13	8.69	1.702	19.59% < 30%	80.41%
Academic Advising	13	8.08	1.382	17.10% < 30%	82.90%
Construction-Oriented Learning Communities	13	7.54	1.506	19.97% < 30%	80.03%
Academic Workshops	13	6.92	1.656	23.93% < 30%	76.07%
Extracurricular Activities	13	5.46	1.664	30.10% > 30%	69.90%

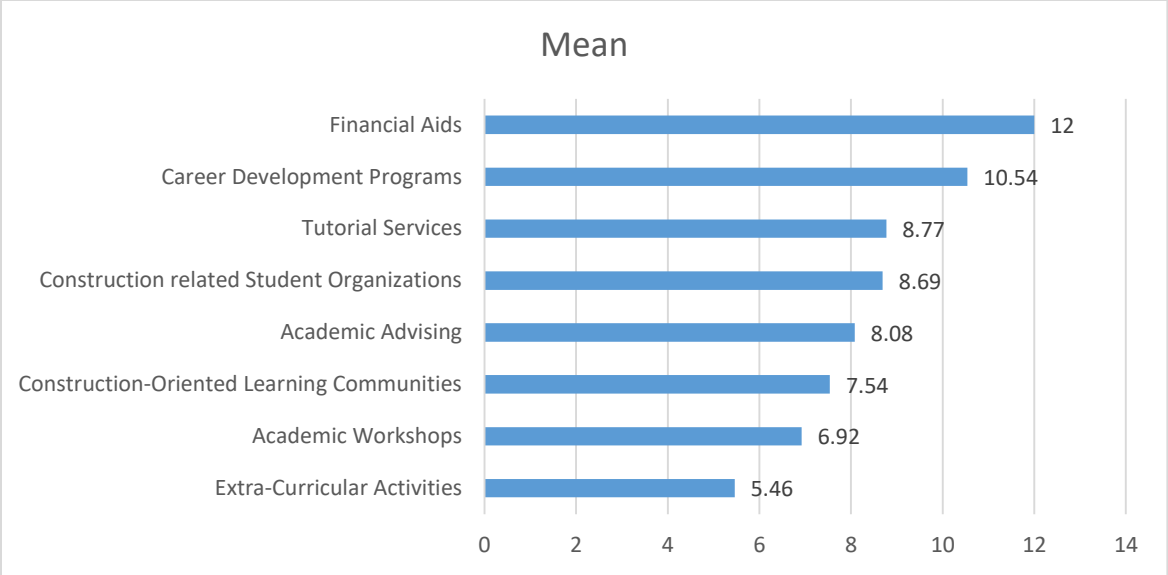

Figure 42. Mean of retention factors for Hispanic industry panelists

Table 39. Standard Deviation to Mean Ratio of Retention Factors for Non-Hispanic Industry Panelists

Factor	N	Mean	Std. Deviation	(Std. Deviation / Mean) × 100	Consensus Percent
Financial Aid	3	11.67	0.577	4.94% < 30%	95.06%
Academic Advising	3	9.67	2.082	21.53% < 30%	78.47%
Career Development Programs	3	9.33	2.082	22.32% < 30%	77.68%
Tutorial Services	3	9.00	1.000	11.11% < 30%	88.89%
Construction-Related Student Organizations	3	8.33	2.517	30.22% < 30%	69.78%
Academic Workshops	3	7.33	2.309	31.50% < 30%	68.50%
Extracurricular Activities	3	6.33	2.309	36.47% > 30%	63.53%
Construction-Oriented Learning Communities	3	6.33	1.155	18.25% < 30%	81.75%

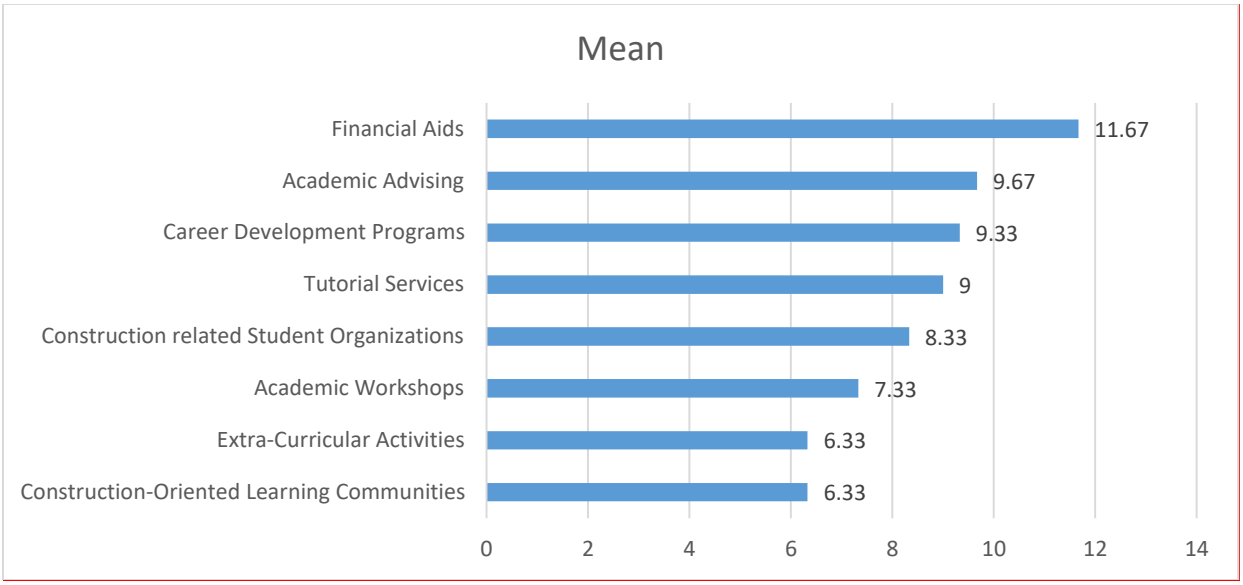

Figure 43. Mean of retention factors for non-Hispanic industry panelists

Industry Professional (Control Group) Results

The results for the control group shows that Hispanic industry professionals who graduated with an undergraduate degree in construction education perceived financial aid, career development programs, and tutorial services as the top three most important retention factors. Details of the findings are as follows:

1) Financial aid
2) Career development programs
3) Tutorial services
4) Construction-related student organizations
5) Academic advising
6) Construction-oriented learning communities
7) Academic workshops
8) Extracurricular activities

CHAPTER V

CONCLUSION AND RECOMMENDATIONS

The purpose of this study was to identify the factors contributing to the retention of Hispanic students in construction science education and then to explore which of those factors has the strongest positive effect on Hispanic students completing construction science education programs. In particular, this study critically investigated the impact of retention factors on Hispanic students in their construction science education.

A mixed methods research synthesis (MMRS) was employed to analyze a body of empirical articles reporting on the factors impacting Hispanic student retention in construction education. The literature revealed different factors including financial aid, construction-related student organizations, tutorial services, academic advising, career development programs, academic workshops, construction-oriented learning communities, undergraduate research experience, extracurricular activities, mentoring programs, Hispanic faculty members in the construction program, and Hispanic peers and students in the construction program.

In an effort to identify which factors have the strongest effect to assist undergraduate construction programs in determining where best to focus retention strategies to enhance Hispanic student success, this study employed the Delphi method on two levels:

- Academic level (experiment group)—consisting of academic experts in the area of construction education or Hispanics in construction education
- Construction industry level (control group)—consisting of professionals working in the construction industry who graduated with an undergraduate degree in construction education

A summary of the Delphi method for this study is as follows:

- This study included three rounds for the academic level (experiment group) and two rounds for the industry level.
- Panel sizes for academic experts (experiment group) in round one, round two, and round three were 6, 27, and 19, respectively.
- Panel sizes for construction industry professionals (control group) in round two and round three were 26 and 16, respectively.
- Academic experts (experiment group) in this study scored a minimum of 11 total points in an expert evaluation system and came from 11 distinct construction education programs in Texas.
- For the industry level, panelists consisted of construction professionals who held an undergraduate degree in construction education and came from 11 distinct contractors in Texas.
- In order to improve the validity of the study, intergroup analysis was applied before combining data to test for any substantially similar agreement among respondents (Hon et al., 2012). This study employed nonparametric statistical techniques including Mann-Whitney U and Kruskal-Wallis testing for measuring intergroup comparison. SPSS software was used for conducting statistical analysis on the Delphi data.

  The following paragraphs summarize the study findings for each round:

Round 1

In order to further refine the retention factor list identified through the literature review, open-ended interviews were conducted with academic experts (experiment group). By categorizing the responses of the interviews, six unique themes emerged, but the emerged themes

are either associated with barriers to retaining Hispanic students or are categorized as precollege retention factors, and the current study focused on which retention strategies are most influential in retaining Hispanics in undergraduate construction education; therefore, the retention factor list identified through the literature review was not refined or changed.

Round 2

This round asked panelists (both academic experts and construction industry professionals) to evaluate the level of importance of each factor impacting the retention of Hispanic students in undergraduate construction education. Findings highlights in this round include the following:

- All factors obtained a mean greater than three by both academic experts (experiment group) and industry professional panelists (control group), validating the literature that all identified factors should be considered to have a positive impact on Hispanic student retention.
- The average ranking obtained from academic expert panelists (experiment group) is as follows:
    1) Financial aid
    2) Academic advising
    3) Mentoring programs
    4) Tutorial services
    5) Hispanic peers and students in the construction program
    6) Hispanic faculty members in the construction program
    7) Career development programs
    8) Construction-related student organizations
    9) Academic workshops

10) Construction-oriented learning communities

11) Extracurricular activities

12) Undergraduate research experience

- The average ranking obtained from industry professionals (control group) is as follows:

1) Financial aid

2) Career development programs

3) Construction-related student organizations

4) Tutorial services

5) Academic advising

6) Construction-oriented learning communities

7) Academic workshops

8) Extracurricular activities

9) Hispanic peers and students in the construction program

10) Hispanic faculty members in the construction program

11) Undergraduate research experience

12) Mentoring programs

Taking Miller's law into account, ranking order questions in this round comprised eight of the most important retention factors from round two.

Round 3

This round provided the Delphi panelists, both academic experts and construction industry professionals, the opportunity to reconsider the scores they provided in round two. Findings highlights include the following:

- By comparing the results from Hispanic and non-Hispanic academic expert panelists with the results from all academic experts (experiment group), the following were found:
  - Financial aid, academic advising, and mentoring programs were the top most important factors among all these three groups (Table 40).
  - While all academic experts (both Hispanics and non-Hispanics) ranked financial aid, academic advising, and mentoring programs first, second, and third, respectively, Hispanic expert panelists ranked mentoring programs above academic advising (Table 40).
  - Construction-related student organizations as a ranking factor stayed consistent among all academic experts (both Hispanics and non-Hispanics) as the least important factor on the list (Table 40).

Table 40. Comparison between Hispanic and Non-Hispanic Academic Experts' Ranking

Rank	All Academic Experts	Hispanic Experts	Non-Hispanic Experts
1	Financial Aid	Financial Aid	Financial Aid
2	Academic Advising	Mentoring Programs	Academic Advising
3	Mentoring Programs	Academic Advising	Mentoring Programs
4	Tutorial Services	Tutorial Services	Hispanic Peers and Students in the Construction Program
5	Hispanic Peers and Students in the Construction Program	Hispanic Faculty Members in the Construction Program	Tutorial Services
6	Career Development Programs	Career Development Programs	Career Development Programs
7	Hispanic Faculty Members in the Construction Program	Hispanic Peers and Students in the Construction Program	Hispanic Faculty Members in the Construction Program
8	Construction-Related Student Organizations	Construction-Related Student Organizations	Construction-Related Student Organizations

- The results of the industry professionals (control group) showed that Hispanic industry professionals who graduated with an undergraduate degree in construction education

perceived financial aid, career development programs, and tutorial services as the top three most important retention factors (Table 41). In addition, Industry panelists reached consensus about the level of importance of all retention factors except for extracurricular activities, as the standard-deviation-to-mean ratio of this factor was more than 30%.

Table 41. Comparison between Hispanic and Non-Hispanic Industry Professionals' Ranking

Rank	All Industry Professionals	Hispanic Professionals	Non-Hispanic Professionals
1	Financial Aid	Financial Aid	Financial Aid
2	Career Development Programs	Career Development Programs	Academic Advising
3	Tutorial Services	Tutorial Services	Career Development Programs
4	Construction-Related Student Organizations	Construction-Related Student Organizations	Tutorial Services
5	Academic Advising	Academic Advising	Construction-Related Student Organizations
6	Construction-Oriented Learning Communities	Construction-Oriented Learning Communities	Academic Workshops
7	Academic Workshops	Academic Workshops	Extracurricular Activities
8	Extracurricular Activities	Extracurricular Activities	Construction-Oriented Learning Communities

- Financial aid was found to be the most important retention factor. This finding was consistent among both academic experts and industry professionals (control group).
- While mentoring programs were reported as the most important factor by the literature and were ranked third by academic expert panelists, this factor was ranked as the least important by industry professionals (control group) in round two, and as a result, it was removed from the round three survey, revealing the limited knowledge of industry

professionals on the impact of mentoring. This limited knowledge can be attributed to the lack of representation of mentoring programs in construction education programs in Texas.

- While undergraduate research activities were among the eight most important retention factors reported by the literature, this factor was ranked as the least important by academic expert panelists in round two, and as a result, it was removed from the round three survey (Table 42). It can be concluded that undergraduate research activities are limited in construction education, and as a result, were ranked as the least important retention factor. This is logical considering that literature findings mainly came from Hispanics in engineering programs, in which undergraduate research activities are more prevalent.

Table 42. Comparison between Literature Review, Academic Level, and Industry Level' Ranking

Rank	Literature Review	Academic Level	Industry Level
1	Financial aid	Financial aid	Financial aid
2	Construction-related student organizations	Academic advising	Career development programs
3	Tutorial services	Mentoring programs	Construction-related student organizations
4	Academic advising	Tutorial services	Tutorial services
5	Career development programs	Hispanic peers and students in the construction program	Academic advising
6	Academic workshops	Hispanic faculty members in the construction program	Construction-oriented learning communities
7	Construction-oriented learning communities	Career development programs	Academic workshops
8	Undergraduate research experience	Construction-related student organizations	Extracurricular activities
9	Extracurricular activities	Academic workshops	Hispanic peers and students in the construction program
10	Mentoring programs	Construction-oriented learning communities	Hispanic faculty members in the construction program
11	Hispanic faculty members in the construction program	Extracurricular activities	Undergraduate research experience
12	Hispanic peers and students in the construction program	Undergraduate research experience	Mentoring programs

Future Recommendations

Based on information gathered and analyzed**,** the following program outline was proposed:

HACS (Hispanic Aggies in Construction Science) Program

The mission of HACS is to retain and graduate Hispanic students in construction science at the same rate as nonminority students. The HACS program expects to have a positive impact on Hispanic students and to have a retention rate within the organization that is higher than rates for non-HACS minority students. The HACS program intends to improve TAMU construction science core academic performance in retention and graduation, along with providing an enhanced supportive environment for Hispanic students as underrepresented minorities. The objectives of the HACS program include the following:

- By fall 2024, the freshman-to-sophomore retention for Hispanic students at the TAMU Department of Construction Science will reach 72.7% (8% increase).
- By fall 2024, the four-year graduation rate of Hispanic students at the TAMU Department of Construction Science will reach 38.5% (20% increase).

1. HACS Financial Aid Package

The HACS program provides two cohorts of 20 students with four-year annual scholarships. The basic qualifications to receive an HACS scholarship are as follows (Jones, Rusch, & Dugas, 2011):

- Full-time enrollment in the construction science program

- 3.0+ university GPA
- Financial need as shown by FAFSA
- US citizen/permanent resident

In order to remain eligible, all HACS students are required to maintain the initial requirements and to continually participate in HACS program activities. In the case that a student does not meet the aforementioned requirements, they are placed on scholarship probation for one semester, with funding at the same level. If the requirements are met at the end of the probation semester, the student remains a funded scholar; otherwise, the student is no longer funded.

2. HACS Advising Program

HACS program advisors monitor and advise students in areas including (but not limited to) the following:

- "Reasonable progress toward graduation
- Evaluation of grades
- Required courses and course prerequisites
- Graduation requirements
- Transfer credits
- University requirements
- Early warnings
- Answered questions about courses and scholarships" (Crown et al., 2009, p. 14.1080.5)

3. HACS Mentoring Program

In addition to providing students with financial aid, the HACS program provides students with targeted mentoring, which serves as the main component of the HACS program. One study participant mentioned mentoring as an "unbelievably important factor" impacting Hispanic student retention in undergraduate construction education. The HACS mentoring program consists of mentoring provided by a construction industry advisory committee (CIAC).

For the CIAC mentoring, preferred mentors are Hispanic construction managers and first-generation college students. The CIAC mentoring program assists HACS students in receiving recommendations and hearing advice from alumni who have been successful construction professionals. In addition, CIAC mentoring provides students with a role model of success in the form of Hispanic individuals in construction science. CIAC mentoring relationship suggestions include (but are not limited to) the following (Marosi & Steinhurst, 2012):

- Mentors answer questions about career goals and career opportunities.
- The relationship facilitates internship and career development activities in the third and fourth years of the construction science program.
- Mentors share their personal experiences as a method to motivate Hispanic students to push through academic hardships, specifically those they encounter in their construction science education.
- Students and CIAC mentors share several meals together during the academic year on the Texas A&M University campus, and students are invited to visit partner offices and project sites.
- When an HACS student graduates, the industry partners benefit from having built relationships with well-prepared construction graduates.

4. HACS Faculty Development Workshops

The HACS program holds multiple faculty and staff development workshops associated with social-emotional factors impacting Hispanic student retention during their education. The factors include (but are not limited to) the following:

- Challenging stereotypes and reducing unique barriers encountered by Hispanic students during their undergraduate education
- Increasing faculty awareness about specific aspects of Hispanic cultures such as respect, machismo, etc.
- Methods for structuring curricula and classroom interactions to foster the creation of inclusive classrooms for Hispanic students

Workshop speakers are selected from faculty who show expertise in the areas of Hispanic culture, educational psychology, social psychology, and construction education.

5. Construction-Related Student Organizations

Hispanic students in the HACS program are required to participate in the activities of construction professional associations that can support students' professional, leadership, and teamwork skills. These associations include Associated Builders and Contractors (ABC), Associated General Contractors (AGC), and National Association of Home Builders (NAHB). Association activities focus on enhancing students' education and professional development.

Program Effectiveness Assessment

To assess the program after each semester, a survey is administered to student participants. The intent of the survey is to understand student perceptions of the different HACS components

and their effect on the student's decision to continue in their chosen field of study (Davis et al., 2007). In addition, effectiveness is assessed with a variety of outcome indicators, most importantly retention, but also other factors such as course performance and, eventually, graduation rates.

Future Study

This paper suggests some directions for future study. Areas worthy of exploration include (but are not limited to) the following

- Which type of financial aids have the largest retention effects on Hispanic students in higher education construction programs? Need-based aid or merit-based aid?
- Which proportion of financial aids should be allocated to freshmen, continuing, and transfer Hispanic students?
- Should financial aid be based on academic benchmarks such as GPA and class credits to make academic progress as well as Hispanic student supports?
- Which one is more efficient? Academic advisement quantity or quality in construction education?
- How does the selection of advisors impact academic advising efficiency in retention improvement of Hispanic students in higher education construction programs?
- How should advisors be prepared and developed to have the best impact on Hispanic students' retention rate?
- How should advisors be assessed in order to improve their effectiveness on increasing Hispanic students' retention rate?

- Which mentoring approach is more effective in retention of Hispanic construction students? Hierarchical (e.g. student-faculty member or student-adviser) or peer (e.g. student-student) mentoring? Which one is more common? Why?
- How to best combine Hierarchical and peer mentoring in complimentary ways to improve Hispanic students' retention rate?

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APPENDIX A

DIVISION OF RESEARCH

TEXAS A&M UNIVERSITY

APPROVAL OF RESEARCH
Using Expedited Procedures

November 28, 2017

Type of Review:	Submission Response for Initial Review Submission Form
Title:	Investigating the Factors Impacting Hispanic Students' Retention in Higher-Education Construction Programs: The Modified Delphi Method
Investigator:	Edelmiro F Escamilla, PhD
IRB ID:	IRB2017-0868D
Reference Number:	067447
Funding:	None
Documents Approved:	IRB Application v. 1.3 Informed Consent- Revised v. 1.1 Survey v. 1.0
Special Determinations:	Waiver approved under 45 CFR 46.117 (c) 1
Risk Level of Study:	Not Greater than Minimal Risk under 45 CFR 46 / 21 CFR 56
Review Category:	Category 7: Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies

Dear Edelmiro F Escamilla, PhD:

The IRB approved this research from 11/28/2017 to 11/27/2018 inclusive.

It is recommended that you submit your next continuing review by 10/27/2018 to avoid a lapse in approval. Your study approval will end on 11/27/2018.

Your study must maintain an **approved status** as long as you are interacting or intervening with living individuals or their identifiable private information or identifiable specimens.

Obtaining identifiable private information or identifiable specimens includes, but is not limited to:

1. using, studying, or analyzing for research purposes identifiable private information or identifiable specimens that have been provided to investigators from any source; and
2. using, studying, or analyzing for research purposes identifiable private information or identifiable specimens that were already in the possession of the investigator.

In general, OHRP considers private information or specimens to be individually identifiable as defined at 45 CFR 46.102(f) when they can be linked to specific individuals by the investigator(s) either directly or indirectly through coding systems.

If you have any questions, please contact the IRB Administrative Office at 1-979-458-4067, toll free at 1-855-795-8636.

Sincerely,
IRB Administration