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An Evaluation of Factors for Retaining Hispanic Students in Undergraduate Construction Programs

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The number of Hispanic workers in the construction industry is more than any other industry in US, but they are under-represented in management position. In an attempt to grow the number of Hispanic construction managers, there should first be a growth in Hispanics obtaining construction science degrees. Retention of Hispanic students who could be the future construction professionals is a problem in Construction education. The objective of this study was to explore which of the factors reported by the literature, have the strongest positive effect on Hispanic students in undergraduate construction education programs. In order to identify which factors, have the strongest impact to assist undergraduate construction programs in determining where best to focus retention strategies to enhance Hispanic student success, this study employed the Delphi method. The results of the study showed that "financial aid", "academic advising", and "mentoring programs" were the topmost important factors. Additionally, it was found that "Construction-related student organizations" as the least important retention factor on the list. Research in the area of Hispanics in construction education is limited. This study can serve as a basis for future research in Hispanic students' retention.

Key Words: Construction Education, Retention, Hispanics, Construction Industry, Workforce Development.

Introduction

The number of Hispanic employees in the construction industry is more than any other industry; they constitute 30% of the U.S. construction industry employees (BLS, 2019a). This is in marked contrast with their representation in management positions in the industry which is predominantly made up of white (90.9%) (BLS, 2019b). Moreover, Hispanics lag behind other population groups in obtaining bachelor's degrees: only 6.9% of Hispanics in the construction industry have a bachelor's degree or higher, and almost 80% of them have less than a high school diploma or high school diploma (CPWR,

2018). According to BLS (2016) by the year 2060, the share of Hispanics/Latinos in the American workforce would increase by 83%. In addition, there is a call for bilingual and bicultural construction managers for foreman and supervisory roles in the construction industry (NAHB, 2015), which point towards a need for more Hispanics in management positions (Ostadalimakhmalbaf, 2018).

In an attempt to grow the number of Hispanic construction managers, there should first be a growth in Hispanics obtaining construction science degrees (Escamilla et al., 2016; Escamilla & Ostadalimakhmalbaf, 2016). Retention of Hispanic students who could be the future construction professionals is a problem in Construction education (Escamilla et al., 2018; Bigelow et al., 2016). While the main reasons for the low retention rate of Hispanic students should be investigated, the focus of this study is not the problem of retention, but rather what retention strategies are most effective.

Background

A study by Ostadalimakhmalbaf et al. (2019) employed Mixed Methods Research Synthesis (MMRS) to analyze a body of empirical articles reporting on the factors impacting the retention of Hispanic students in higher education. According to Sandelowski et al. (2012) MMRS is defined 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). The factors revealed by Ostadalimakhmalbaf et al. (2019) 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.

While findings in Ostadalimakhmalbaf et al. (2019) mainly came from Hispanics in engineering programs, there is still a question which one of the reported retention factors are specifically most influential in improving Hispanic students' retention in undergraduate construction programs. As a result, the objective of this study was to explore which of the factors reported by the literature, have the strongest positive effect on Hispanic students in undergraduate construction education programs. 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.

Research Methodology

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). The Delphi panelists for this study

consisted of academic experts in the area of construction education or Hispanics in construction education. This study obtained IRB approval prior to any data collection.

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, 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). Additionally, 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 Delphi panelists, this study employed criteria recommended by Hallowell and Gambatese (2010) to qualify an individual as a panel "expert." Specifically, an identified panel expert scored a minimum of 11 total points in an expert evaluation system, to qualify for participation in the study. The Delphi panelists 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.

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 two iterations because this study reached desired consensus between panelists in the second round.

Number of Expert Panelists

While previous literature provides no particular guidelines on the number of Delphi panelists, out of 67 studies using the Delphi method in the area of construction engineering and management, a majority (62%) 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). The panel sizes for round one and round two were 27, and 19, respectively.

Description of Each Delphi Round

In order to further refine the retention factor list identified through the literature review with open-ended interviews with the Delphi panelists prior to initiating the Round one. This stage 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 stage, qualitative data coding was used to search for any themes present. Hence, different responses were produced by interviewing six panel experts. 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; and, 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 stage took 10 days.

Round One

This round aimed to ask the Delphi panelists 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 the previous stage, the Delphi round one 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 question.

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 panel 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 Two

This round aimed to provide Delphi panelists with the opportunity to reconsider the scores they provided in round one. By analyzing the results obtained from round one, the Delphi round two questionnaire was developed. The round two survey included only one ranking order question. Based on feedback from the Delphi panelists regarding the ranking order question in round one, 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 one. 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, respectively. 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.

Data Analysis and Findings

Data Analysis is 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).

Demographic Information

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. The highest percentage was related to a construction-oriented degree area (74.1%). Nonconstruction-oriented education degrees accounted for 18.5%. Only 7.4% of respondents had neither a construction- nor an education-oriented degree. 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. In addition, 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.

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

Rating the Retention Factors

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. Moreover, 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. In addition, 55.5% of the participants 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. Moreover, most of the participants (74%) reported tutorial services as being either quite important or very important in their opinion. Only 3.7% reported that such services have no importance.

When participants were asked about academic advising, while most of them (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. Similarly, a majority of participants (88.9%) stated that career development programs are either quite important or very important in their opinion and only 3.7% reported feeling that such programs are of little importance. Furthermore, 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.

In regard with the construction-oriented learning communities, a majority of participants (77.7%) reported that these communities are either quite important or very important in their opinion. Only 18.5% participants stated feeling that this factor have either no importance or little importance. Besides, 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. Next, 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.

Its noteworthy to mention that 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. Further, 73.1% of participants 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. Finally, results show that 70.3% of the participants reported that having Hispanic peers and students in a 258 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.

The results show that 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. 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 show statistically significant evidence (95% significance) that there is a difference in panelist rating 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 ratings of the aforementioned factors. The Kruskal-Wallis test was also used to compare rating differences based on different years of teaching experience. The p-values obtained through the Kruskal-Wallis test indicate no statistically significant evidence (P > 0.05 at a 95% significance level) of a difference in ratings among participants with different periods of teaching experience. 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. Hence, a nonparametric Mann-Whitney U test was run to compare response differences between the two subgroups. It was found that, 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 rated the aforementioned factors using a five-point Likert-type scale.

Ranking the Retention Factors in Round one

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:

Average ranking = $[XAWA + XBWB + \cdots + XGWG] \div Total$ (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 the factor was 3. "Total" refers to the number of respondents filling in the questionnaire (Liu & Wu 2017).
Average ranking is as follows: financial aid as 12 (mean=11.08-most important), academic advising as 11 (mean=8.5), mentoring programs as 10 (mean=8.08), tutorial services as 9 (mean=6.96), Hispanic peers and students in the construction program as 8 (mean=6.92), Hispanic faculty members in the construction program as 7 (mean=6.5), career development programs as 6 (mean=6.48), construction-related student organizations as 5 (mean= 6.13), academic workshops as 4 (mean=5.61), construction-oriented learning communities as 3 (mean= 5.43), extracurricular activities as 2 (mean= 3.92), and undergraduate research experience as 1 (mean= 3.7, least important).

Ranking the Retention Factors in Round Two

This round provided the Delphi panelists the opportunity to reconsider the scores they provided in round one. 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 one 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 , and, 8) Construction related student organizations. In this round, the Delphi panelists reached consensus about the level of importance of the factors impacting Hispanic student retention in undergraduate construction education. The results revealed that 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.

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.

Conclusion and Suggestions

This study adds to the body of Knowledge by critically investigating the influence of retention factors on Hispanic students in their undergraduate construction education. Based on the findings of the study, all factors obtained a mean greater than three by Delphi panelists in round one, validating the literature that all identified factors should be considered to have a positive impact on Hispanic student retention. Furthermore, the average ranking obtained from Delphi panelists in round two 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) Career Development Programs, 7) Hispanic Faculty Members in the Construction Program, and, 8) Construction-Related Student Organizations.

By comparing the results from Hispanic and non-Hispanic Delphi panelists with the results from all Delphi panelists, the following were found it was found that Financial aid, academic advising, and mentoring programs were the topmost important factors. On the other hand, Construction-related student organizations as a ranking factor stayed consistent among all Delphi panelists (both Hispanics and non-Hispanics) as the least important factor on the list. Finally, while all the Delphi panelists (both Hispanics and non-Hispanics) ranked financial aid, academic advising, and mentoring programs first, second, and third, respectively, Hispanic panelists ranked mentoring programs above academic advising.

Future research that will use professionals working in the construction industry who graduated with an undergraduate degree in construction education as Delphi panelists is recommended. The industry professional group will serve as a control group and their responses will be compared with the result of the current study (academic expert panelists). Research in the area of Hispanics in construction education is limited. This study can serve as a basis for future research in Hispanic students' retention.

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