

Developing an Effective Construction Training Program for Hispanic and American Craft Workers and Supervisors

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16. Abstract <p>Hispanics are a large and growing part of the United States workforce. Projections of the U.S. Census Bureau (2001) state that, by the year 2050, Hispanics will account for 25% of the population. For the Midwest in particular, the Hispanic population is expected to increase 35% by the year 2025. The construction industry is expected to experience a greater percentage increase of its Hispanic population, due to the labor-intensive nature of the industry.</p> <p>This study addresses the expected increase of Hispanic workers in the construction industry by testing the best approaches for delivering training to construction crews with Hispanic workers as well as American supervisors and laborers in the state of Iowa. The research methodology consisted of assessing the effects on communication, safety, work environment, and productivity as a result of the integration training.</p> <p>Results show that integration on-site training decreases workers' desire to move and increases quality of work and productivity. Most importantly, experimental design was used to show the increasing levels of direct construction communication due to the Toolbox Integration Course for Hispanic Workers and American Supervisors (TICHA) designed as part of this project.</p> <p>This study recommends the creation of a quasi-governmental or association program that can offer continuous research and training that can benefit the construction industry as well as society as a whole. The industry involvement in this process is crucial for contractors. Not only do contractors benefit from reduced insurance premiums when workers act safely, but workers with better communication skills are more productive.</p>					
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DELIVERING AN EFFECTIVE CONSTRUCTION TRAINING PROGRAM FOR HISPANIC AND AMERICAN SUPERVISORS AND CRAFT WORKERS

**Final Report
December 2007**

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EXECUTIVE SUMMARY

The accelerated growth rate of Hispanics has a substantial effect on the labor force environment in the United States. By 2003, Hispanics accounted for 23% of the total of the construction industry force (BLS 2004). This rapid growth represents a new challenge for construction companies, due to the raising of new problems related to the diversification of the workforce. Communication and language issues, for example, have become an extended problem amongst construction crews. The Center to Protect Worker's Rights (CPWR 2004) determined that as many as 45% of the Hispanic workers interviewed recognized problems in communication, and as many as a third were not able to speak English at all.

In Iowa, language barriers have been previously determined as a common problem in construction crews by the Hispanic Workforce Research Project (HWRP). In phase II of this project, Vazquez (2005) determined that more than 80% of the supervisors interviewed recognized language and communication problems as a main factor rising conflicts on the jobsite. In addition, it was considered that language limitations may affect productivity, workplace safety and the effectiveness of DOT training on the construction crew. Therefore, in Phase III of this project, Aveiga-Alcivar et al. developed a Toolbox Integration Course for Hispanic Workers and American Supervisors (TICHA), focused on improving the level of language knowledge and integration among Hispanic and American workers on the jobsite.

The objective of HWRP Phase IV was to quantify the effect of the implementation of TICHA training in both language proficiency and crew cohesiveness among workers in Iowa construction crews with Hispanic workers. All 55 participants were given a test measuring language proficiency for their non-native language (either Spanish or English) at the start of the construction season in (May–June) 2006. Thirty-seven participants (67%) were grouped in six crews and received nine TICHA modules focused on language development and group interaction, whereas the remaining 18 workers (four crews) comprised the control group. A final test was applied at the end of the season (November 2006) to measure the language progress between the experimental and control groups

Results demonstrated that the crew members reacted positively to the training. Attendance to classes reached 90% on average. The Hispanic and American workers who attended the training showed remarkable improvement in their knowledge of non-native language words, although the improvement among Hispanics was present even among workers who did not receive training (i.e., workers who were in the control groups). In contrast, Americans in control groups did not learn Spanish words during the construction season. Among Hispanics, the rate of learning was accelerated in experimental groups in comparison with control groups. Perceived confidence in communication also changed through time among workers. Interestingly, Hispanics on average learned more English vocabulary words than Americans. Meanwhile, Americans reported having a higher degree of confidence for speaking Spanish post-training.

Similar to previous studies, language and communication problems were rated by American supervisors and Hispanic workers as the most frequent reason for conflict among peers. Moreover, the frequency of personal conflicts in the crew was negatively correlated with the

supervisor's perceived productivity, suggesting that the rise of personal conflicts diminishes the potential efficiency of the crew. In contrast, the frequency of problems arising from unsafe behavior was perceived as low for all members, suggesting that safety practices are rarely a reason for disagreements among workers. Conflict resolution strategies varied among workers, depending on their cultural background and position in the crew. In general, compromising and negotiation strategies were highly rated for all participants, suggesting that these strategies are well accepted among peers as a way to solve conflicts. However, forcing (i.e., reaching no compromise or negotiation) was highly rated by supervisors but not by workers, whereas avoiding the issue was preferred by Hispanic workers but not by American workers, suggesting that variations in conflict resolution strategies among groups were based not only on job hierarchy but also on cultural background.

In conclusion, this study highlighted the importance of conducting research with non-English speaking populations in the construction industry. It emphasized the need to design and deliver linguistic and culturally appropriate materials that could be easily understood by the target audience. In addition, such activities might contemplate the interaction among all cultural groups in the crew as an attempt to improve cohesiveness and reduce the risk of personal conflicts. Future investigations should focus on monitoring the training over a longer time scale and should identify the economic impact that personnel turnover has on crews' performance.

1. INTRODUCTION

1.1. Problem Statement

The Hispanic population is heavily impacting U.S. demographics. Currently, Hispanics are the ethnic group with the highest growth rates of immigration to the United States. The Hispanic workforce in the United States grew from 5.9% in 1980 to 20% in 2000. In addition, the Hispanic workforce is expected to increase 36% in 2010, whereas the national workforce is projected to grow only 12% during the same period. The participation of Hispanics in the construction industry has been continuously growing. In 1996, Hispanic workers comprised 10% of the construction workforce; by 2001, they made up 18% of the construction workforce, accounting for more than 1.3 million workers currently. The Hispanic population is overrepresented in some of the most dangerous occupations; in addition, they have the highest fatality and injury occupational rates in comparison with any other cultural group in the United States (O'Connor et al. 2005). According to the Bureau of Labor Statistic (2005), the fatality rate for Hispanics is about 20% higher than the rates for white or black laborers.

To date, very little construction research has targeted the Hispanic workforce in the United States. In fact, Brunette (2004) mentioned that only one study out of 106 funded by the United States National Institute of Occupational Safety had a Hispanic component. In addition, there is a lack of dissemination of the results in mainstream media as well as poor training programs that consider the Hispanic component among companies (Arbalaez 2004). In consequence, even when the importance of the Hispanic workforce is widely recognized among construction companies (Nash 2004; AFL-CIO 2005), the impact of a multicultural environment in terms of productivity and safety is still poorly known.

Iowa construction crews are changing rapidly with the incorporation of Hispanic laborers into the workforce. A previous study developed by the Hispanic Workforce Research Project (HWRP) (Canales et al. 2007) showed that, by 2005, 60% of the supervisors in central Iowa reported more than seven Hispanic workers in their crew. At the same time, 62% of Hispanic and 84% of American supervisors were not satisfied with their proficiency speaking English or Spanish, respectively. Moreover, 78% of the American supervisors used English as the only language to communicate on the jobsite, which parallels 82% of respondents stating that communication and language barriers were the main reason for job conflicts. These findings highlighted the need for implementation of appropriate training programs to increase not only communication skills but also cultural integration between American and Hispanic workers and supervisors on the construction jobsite.

1.2. Research Objectives

The HWRP developed an array of training tools and course materials aimed to improve the preparation of Hispanic workers to function in the construction environment in the United States. In most cases, the materials attempted to incorporate Hispanic workers, American supervisors, and DOT inspectors. Nevertheless, it was difficult to achieve full attendance of participants to

formal classes because of the typical constraint of time. Indeed, the HWRP developed a new approach, named Toolbox Integration Course for Hispanic Workers and American Supervisors (TICHA). The new course involves a series of 30-minute modules to be delivered directly on the jobsite, at times that are previously arranged with the supervisor and in accordance with the disposition of the crew. Therefore, the course fulfills the objective of increasing language skills and integration within the crew, with minimal disruption on the crew's daily operations.

The first objective of this study was to quantitatively measure the effect of TICHA on the communication skills of Hispanic and American workers in construction crews in central Iowa. In addition, this study also measured the acceptance of the methodology among workers and supervisors, including material quality, teaching approach, vocabulary and phrases studied, and time use.

The second objective was to understand the effect of cultural diversity on productivity and conflict resolution among construction crew workers in Iowa. This objective includes the estimation of conflict frequency, the perceived differences in conflict resolution between cultural groups, and the effect of conflict frequency on productivity and work quality. Finally, the study included the supervisors' perceived value of Hispanic workers in comparison with American workers.

1.3. Research Approach

In order to achieve the stated objectives, the on-the-job training course TICHA was delivered to six construction crews specializing in road and bridge maintenance, whereas four crews functioned as control groups.

A test measuring the language proficiency of each laborer was performed before training. American and Hispanic workers tested their proficiency recognizing Spanish and English words and phrases directly related to construction terminology or basic skills of communication. Along with this test, descriptive information was collected among participants, which included age, education level, time of residence in the United States, and previous experience in construction activities. A second test was performed before training.

Using survey questionnaires at the end of the construction season, the research team collected information about training effectiveness, safety, conflict frequency, and conflict resolution. All surveys were given to the entire crew. Additional surveys were completed by the supervisors, describing the productivity and quality of tasks among workers, who were divided by their cultural background.

2. LITERATURE REVIEW

2.1. Background

Construction is one of the largest industries in the United States, with 11.1 million civilian workers (BLS 2005). This workforce is mainly composed of male workers, ages 25–40, with modest formal education. The increasing reduction of white, American, male employees in the construction workforce resulted in the broadening of recruitment, especially from minorities, such as the Hispanic population, in the U.S. In 2004, Hispanic workers comprised 23% of construction employees, in contrast with only 5% in 1980, becoming the cultural group with the highest growth rate in this sector (BLS 2005). In fact, Hispanics make up an even larger share of construction workers in some construction trades, such as drywalling and concrete, where they comprise as much as 33% of the labor force (CPWR 2002).

The steady rise in Hispanic workers has been coupled with new problems on the jobsite. Safety is probably the most concerning issue. In 2005, work injuries among Hispanics led to 917 fatalities, more than 50% of which resulted from construction operations (BLS 2005). In fact, according to the National Resource Council (2003), Hispanics are 2.5 times more likely to be killed and 1.5 times more likely to be injured than the average American worker, even when they considered that the rate of Hispanic accidents was underreported.

The high rate of accidents in construction tasks is explained by factors inherent to the trade. Construction workers perform several physically demanding tasks with varying levels of exposure to hazard conditions. In addition, most workers are believed to have a less-than-accurate perception of hazardous circumstances (Brunette 2004). For Hispanic workers, the conditions are even more complicated because of their cultural background, which disregards safety procedures, and because of language limitations. As many as 33% of the Hispanics working in construction in the United States do not speak any English, and 45% admit that they speak English less than well (Ruttember and Lazo 2004). This situation is bound to increase the likelihood of accidents as well as increase the number of conflicts on the jobsite, affecting crews' performance and productivity.

Despite the dramatic change in the cultural composition of construction companies, studies about the impact of culture in construction crews have been poorly evaluated. Even so, social analysts suggested that cultural background could be an important factor in understanding work conflicts and group productivity (Arai et al. 2001). In the United States, conflicts among workers in construction companies affect the crew's performance, even when it is not fully recognized. In fact, Thomas (1992) reported that foremen in construction crews spend as much as 20% of their working time solving problems among peers, albeit they did not identify this time as an important chore within their tasks. Nevertheless, foremen in multicultural groups mentioned cultural issues, such as miscommunication and poor language skills, as the most frequent reason for conflicts on the jobsite (Ruttember and Lazo 2004; Vázquez 2005).

2.2. Cultural Background and Productivity: Managing Conflicts in Multicultural Crews

The role of cultural background in conflict resolution has been poorly assessed. Social analysts suggest that cultural bounds among peers could be an important factor in understanding work conflicts as well as solving them (Muchinsky 1990; Arai et al. 2001). Between individualistic and collectivist societies, for instance, it has been proposed that individualistic societies would look for autocratic or adversarial mechanisms to solve problems, whereas collectivist societies would prefer advising or avoiding strategies that would not threaten group interests (Hosftede 1984, 1991; Navahandi 1997). This theory has not been tested so far in the construction environment, as most investigations in this field have been conducted in U.S. and European societies, where individualism is the predominant cultural background (Cropanzano et al. 1999). Therefore, conflict studies involving cultural contrast are poorly described in the literature, although such studies could give important insights into solving work confrontations.

The conflict process is separated into four phases (Figure 1). First, conflict emerges when two parties dispute about the use of resources or information (conflict issues). In the case of information, the conflict might be related to ways to use resources (intellective conflicts) or preferences in the use of resources (evaluative conflicts) (De Dreu et al. 1999). Once the issue has been established, the clash between the parties brings up different feelings about perceptions of each persons' self concept; the other's position and external influences, such as stereotypes; and hierarchical position in the group (conflict experience). The development of the conflict at this point depends upon the conflict management strategy adopted within the group, which can also trigger a feedback of the issue and the conflict experience (Figure 1). Given the importance of conflict management in organizations, there are a myriad of strategies for dealing with friction on the jobsite (Pruitt and Rubin 1986). One of the most accepted theories, called Dual Concern Theory (DCT), was proposed by Blake and Mouton (1964) and revised by Deutch (1973) in his Theory of Cooperation and Competition.

DCT argues that conflict management is a function of self-concern and concern for others. The interaction between these two factors leads to different methods of conflict resolution (De Dreu et al. 2001). For instance, high concern for self and low concern for others results in forcing one's will upon others in order to get agreement, usually by threats, persuasive arguments and positional commitments. In contrast, low concern for self and high concern for others results in a preference for yielding, which leads to accepting others will in the negotiation. Low concern for both self and others results in a preference for avoiding or reducing the importance of the conflict, whereas high concern for self and others will involve a problem solving process, oriented toward an interchange of information among parties and making trade-offs between relevant and irrelevant issues. More recently, human resource managers have been looking for a middle ground, or intermediate concern, in negotiations that leads to a compromising process that could be interpreted as half-hearted problem solving (Pruitt and Rubim 1986), or a strategy that drives two parties to meet in a middle ground (Van de Vliert 1997). Finally, a fourth phase, resolution, would yield an integrative settlement, a compromise between parties, an imposition, or an impasse as outcome, depending on the conflict-management strategy used. Each phase in the process will influence the resulting resolution, which subsequently may define the contextual environment and task performance among peers and eventually reduce future conflicts on the jobsite.

The effect of conflict on task performance is not clearly defined. Most authors differentiate at least two kinds of conflict in the workplace: conflicts related to personal relationships and conflicts emerging from work-team task performance (Jehn 1997). Relationship conflicts have been negatively related to productivity in most studies and are broadly accepted as a detrimental trait to be avoided on the jobsite (De Dreu and Breesma 2005; Dijkstra et al. 2005; Guerra et al. 2005). On the other hand, the effects of task conflicts are amply debated among authors. Some studies see this kind of conflict as being as negative as the relationship conflict (De Dreu and Weingart 2003), whereas others suggest that intermediate levels of conflicts are beneficial and even necessary to improve productivity in work teams (Lovelace et al. 2001; Pelled et al. 1999). The last group of authors argues that lack of task conflict leads to passiveness and that high levels of conflict imply excessive time solving disagreements, but that intermediate levels increase creativity and improve productivity. Therefore, they suggest a curvilinear relationship between task conflict level and team performance (Jehn 1995). This difference in conflict effect on productivity between competitive and negotiating groups is referred to in the literature as the Theory of Cooperation and Competition (Tjosvold et al. 1999).

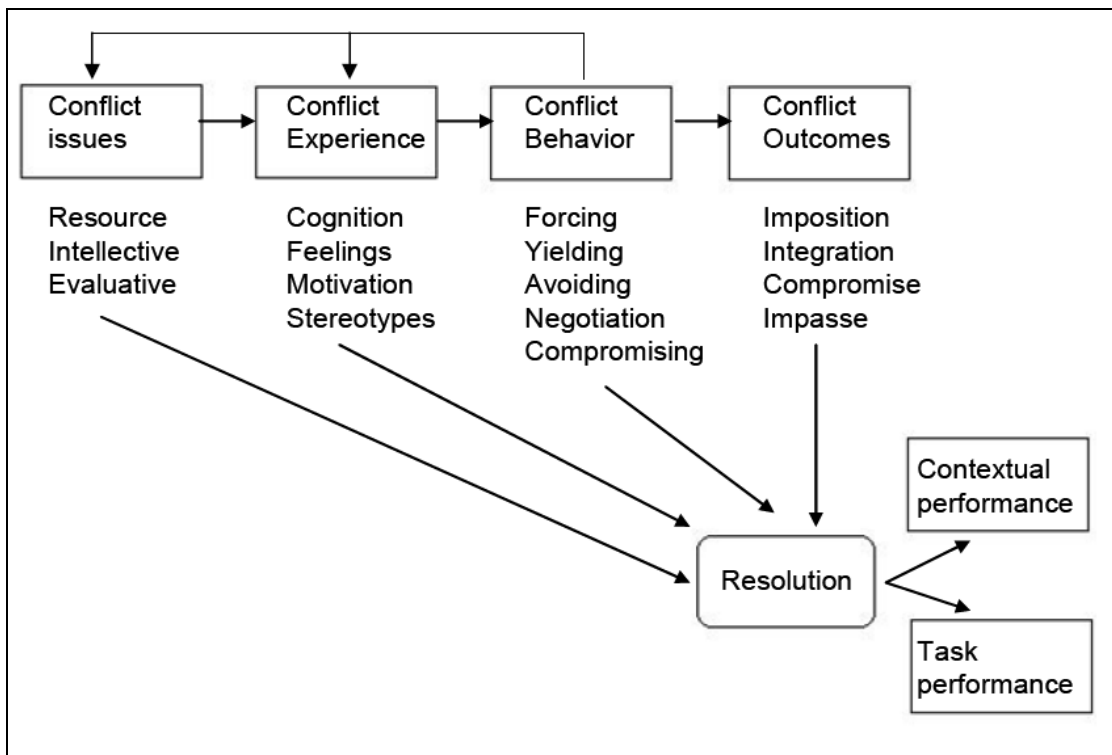


Figure 1. Schematic representation of the conflict process and its relationship with work-team performance

Each box in Figure 1 represents a phase of conflict. On the other hand, below the top boxes are possible issues related to each phase. Each phase has interactions with other phases, which are represented with the arrows. This model has been modified from De Dreu et al. (1999).

Additional studies indicate further variables to consider in work conflict studies. First, the level of complexity in tasks seems to be an important factor (Jehn et al. 1999). Labor-intensive jobs had moderate responses to conflict in comparison with cognitive jobs. On the other hand, cognitive jobs had positive responses to task conflicts whereas any kind of conflict was detrimental in labor-intensive jobs (Pelled et al., 1999). Likewise, task conflicts had greater benefits for groups with higher job security expectations than groups with lower job security expectations (Guerra et al. 2005). Furthermore, management strategies and the presence of a third party in resolving conflicts can have an important impact on the effect of conflicts on worker performance, especially when supervisors maintain a clear division between personal problems and task problems at work (Giebels and Janssen 2005).

Construction companies in the United States are often affected by conflicts among crew workers, although knowledge about the effect of disputes on a crew's performance is relatively limited (De Dreu and Beersma 2005). For instance, Thomas (1992) reported that foremen spend, on average, as much as 20% of their working time solving conflicts in the workplace, even though they did not identify this as an important task within their chores. Ruttember and Lazo (2004) identified miscommunication as one of the most frequent sources of conflicts among construction workers. In their study, they detected that foremen are less willing to explain procedures to non-English speaking workers, even when workers are not trained to do those specific tasks. Also, it is frequent that other laborers get frustrated and yell at workers who do not understand English. Many times, English speakers direct non-language-proficient workers to skip part of the construction process because they could not learn it immediately (Ruttember and Lazo, 2004). As a result, non-English-speaking laborers often work under unsafe conditions, without appropriate equipment and/or productivity limitations.

Based on the current information, we expected four main trends in this study: (1) a significant increase in the proficiency of the secondary language (either Spanish or English among American or Hispanic workers, respectively) for TICHA-trained workers in comparison with control groups; (2) a positive correlation between time of residence in the U.S. and English proficiency among Hispanic workers; (3) a trend to yielding–forcing conflict resolution between Hispanic and American workers; and (4) a negative relationship between conflict frequency and productivity among construction crews.

3. RESEARCH METHODOLOGY

3.1 Crew Profile, Proficiency Test, and Questionnaire Design

Three construction companies (Absolute Concrete Construction, Concrete Foundation, and United Contractors) were interested in the ways in which supervisors and employees dealt with communication problems on the jobsite. All three companies had activities during the 2006 construction season in central Iowa. The study included 55 individuals (37 Hispanic workers, 7 American craft workers and 11 American supervisors), distributed in ten crews among the three companies. All participants had a non-native language test at the beginning of the construction season in (May-June) 2006. Thirty-seven subjects (67%) received nine TICHA modules focused on language development and group interaction, whereas the remaining 18 workers comprised the control group. A final test was applied at the end of the season (November 2006), using the same vocabulary from the pre-season test to measure the language progress between the experimental and control groups.

Table 1. Summary of crews and activities realized during the delivering of the Toolbox Integration Course for Hispanic workers and American supervisors, Phase IV

Company	Supervisor	Hispanic workers	American workers	Classes (sessions)	Classes (hours)	Attendance (%)	Category
United	John	5	1	10	7	98.15	Experimental
United	Jim	9	2	8	6	87.27	Experimental
Concrete	Jay	5	5	8	6	92.22	Experimental
Absolute	Kyle	6	4	6	4	86.67	Experimental
Absolute	Matt	6	1	6	4	91.07	Experimental
Absolute	Jason	6	1	7	5	98.33	Experimental
United	Dave	6	1	2	1	100	Control
Absolute	Cory	2	3	2	1	90	Control
Absolute	Chad	2	1	2	1	75	Control
Absolute	Adam	2	1	2	1	100	Control
Total		49	20	53	53	91.87	

At the beginning of the season, all crews were profiled. Respondents were asked to provide their age, construction experience, education level, and residence time in the U.S. In addition, the interviewees responded to a series of questions related to their perception of communication skills in their non-native language, ability to ask questions, and knowledge of safety measures at the jobsite. All answers were coded using a five-point scale with “1” as the worst condition and “5” as the best. Interviews were performed by the authors.

At the end of the season, in parallel with the proficiency test, the participants evaluated their experience with the TICHA training by considering five dimensions: quality of materials, interactive approach, language and vocabulary, instructor performance, and willingness to take more classes. In addition, the survey included a section assessing their perception of the impact of TICHA sessions on daily activities, including the interference with daily activities, length of sessions, training usefulness, and effect on productivity. Finally, an additional survey was given

to supervisors to measure their perception of time use, effectiveness, functionality, and productivity (as defined by Alper et al. 2000) between Hispanic and American workers within crews.

3.2 Data Analysis

The data set was categorized by cultural groups (American vs. Hispanics) and position in the crew (supervisor, American worker, Hispanic worker). The effect of TICHA on the communication skills of Hispanic and American workers among construction crews was estimated as the difference between the pre- and post-test scores for each individual. Differences between cultural groups and among position in the crew were analyzed with an ANOVA test with a post hoc Bonferroni analysis to detect differences among groups. In addition, the acceptance of the methodology among workers and supervisors, including material quality, teaching approach, vocabulary and phrases studied and time use, was analyzed with individual t-tests.

The effect of cultural diversity on productivity and conflict resolution among construction crew workers was estimated using the final survey. The questionnaire developed by Alper et al. (2002) was used to measure the effect of conflict frequency effect on productivity. The perceived differences in conflict resolution between cultural groups were tested with ANOVA, and the effect of conflict frequency on productivity and work quality were evaluated with Pearson correlations. Finally, the study compared the supervisors' perceived asset of Hispanic workers in comparison with American workers with individual t-tests for each dimension (effectiveness, functionality, productivity and time use).

4. RESULTS

4.1 Crew Profiles

Crew profiles were performed for each company. The description included workers' ages, experience in construction, and years of formal education.

Workers were relatively young, with a mean age of 29 years (Figure 2). Among companies, worker age was similar, with the exception of the supervisors in United Contractors, who were on average 43 years old. Concrete Foundations showed larger variability in the age of Hispanic workers than the other companies, whereas Absolute Construction tended to hire the youngest Hispanic workers. It is important to point out that United is a heavy highway contractor and the other two companies pave secondary roads and walkways (general concrete work). A larger data set with more companies would provide valuable information on how the age of supervisors and laborers may influence relations and productivity, taking into account that highway contractors are more likely to be involved in accidents than general concrete workers.

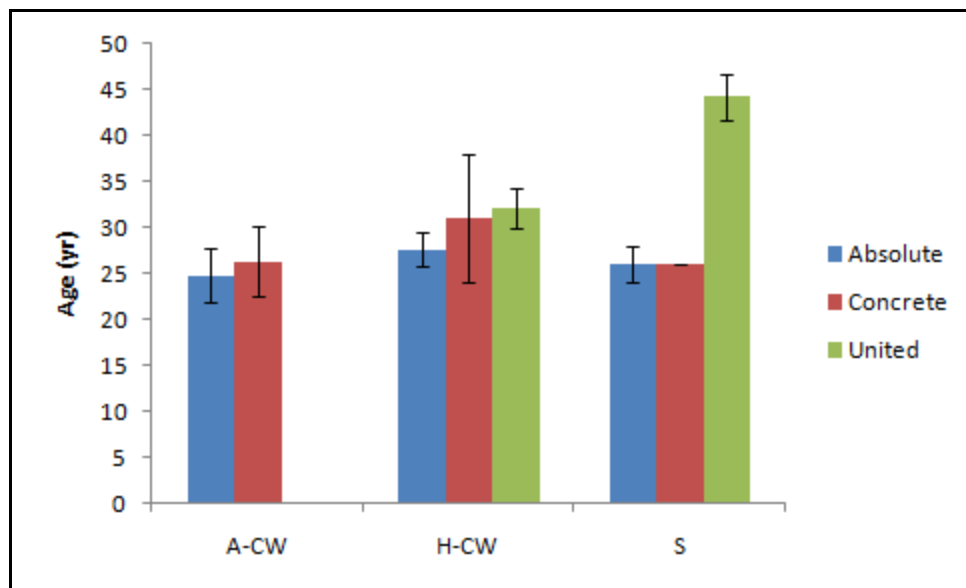


Figure 2. Worker's age sorted by position and company. A-CW: American Craft Workers; H-CW: Hispanic Craft Workers; S: Supervisors

Figure 3 shows that workers' experience in construction was, in most cases, low. In fact, 50% of the workers reported less than four years working in construction. American workers had, on average, more experience than Hispanic workers; however, this result is most likely influenced by the United Contractor supervisors, who had more than 20 years of experience. Interestingly, Hispanic workers at United also had longer periods working for the same company did Hispanics at other companies. In addition, it is noticeable the supervisors in the company specializing on highway and bridge construction (United Contractors) employ the most Hispanic workers. Also, this company employs workers who, in every position, possess more experience in construction

than workers at other companies. Since the other two companies are specialized in smaller-scale concrete work, it was expected that their experience requirement would be lower.

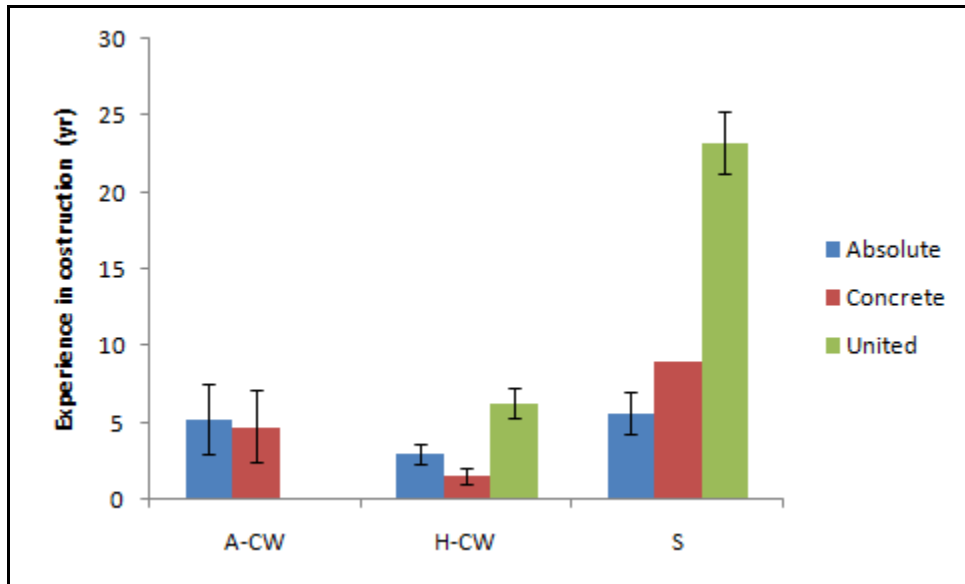


Figure 3. Years of experience in construction among interviewed workers. A-CW: American Craft Workers; H-CW: Hispanic Craft Workers; S: Supervisors

Formal years of education were also considered an important factor for understanding the skill composition of companies (Figure 4). Thirty-eight percent of the workers in this study had at least 12 years of formal education. Fifty percent had less than 12 years of formal education, while only 12% of the subjects had some college education. Hispanics had less formal education than Americans; this trend was steady among companies. Nevertheless, within cultural groups there was not a significant difference in years of education. A larger data set could reveal whether companies are linking higher levels of education with performing more difficult tasks.

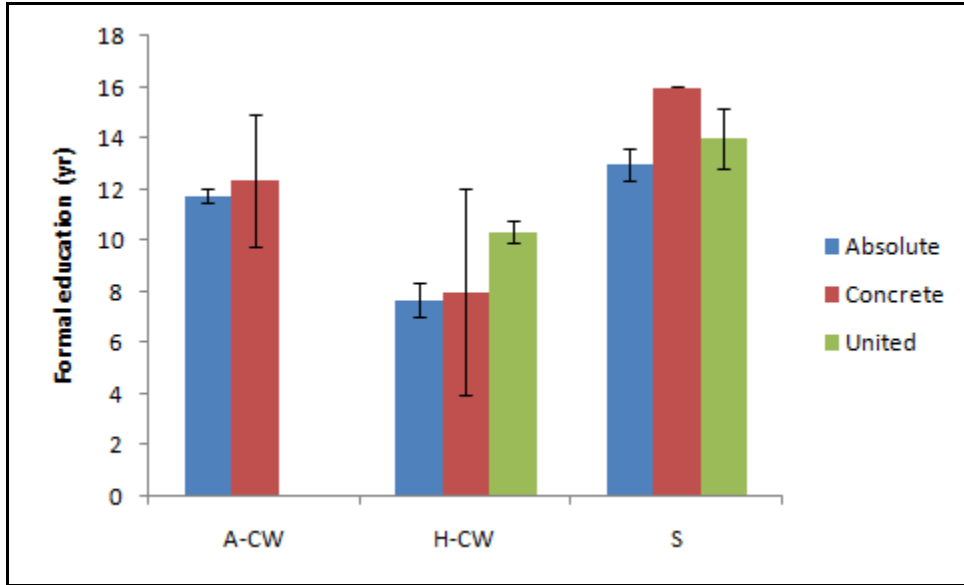


Figure 4. Years of formal education among interviewed workers. A-CW: American Craft Workers; H-CW: Hispanic Craft Workers; S: Supervisors

4.2 TICHA Training Effectiveness on Language Learning

The control groups consisted of the construction crews that did not receive training (Figure 5). The only group showing a considerable difference in language learning was the Hispanic craft worker group. This can be explained by the fact that Hispanics were exposed to English learning throughout the construction season. This difference, however, was not statistically significant.

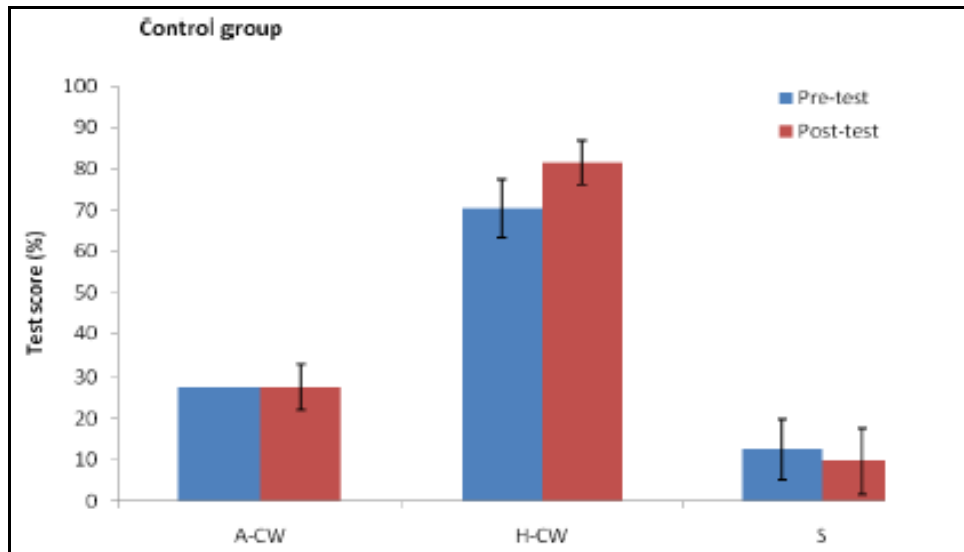


Figure 5. Control group pre- and post-tests by position

The experimental groups consisted of the crews that received training (Figure 6). Supervisors and American construction workers showed the largest significant difference. This suggests that those two groups learned the most in terms of percentages. Hispanics also showed a significant difference in language learning; however, for this group, the pre-test levels of foreign language ability were greater than those for the other two groups.

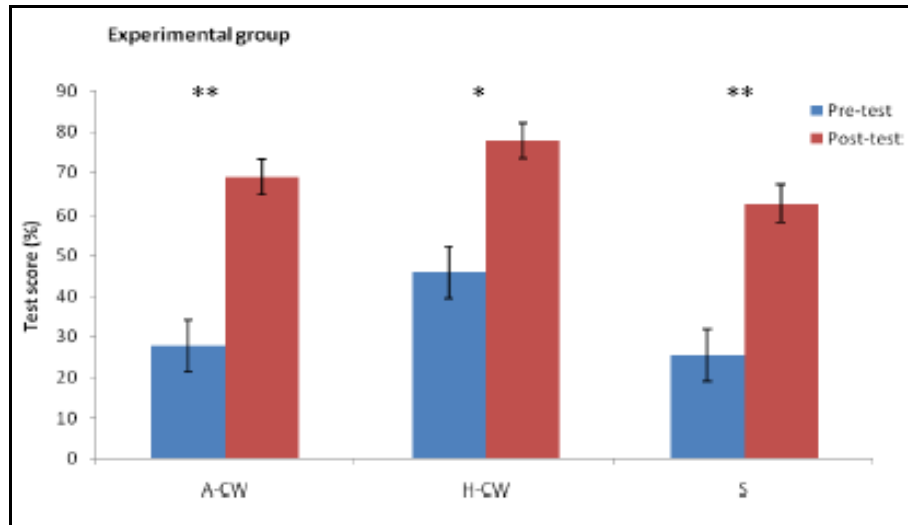


Figure 6. Experimental group pre- and post-tests by position

Note: Workers were grouped by position within the crew.

Grouped bars marked were significantly different (* $p < 0.05$; ** $p < 0.01$).

Hispanics had higher scores on the pre-test than Americans and supervisors; however, the Hispanic control group had higher scores than the experimental group, indicating pre-existing differences between the Hispanic workers assigned to the experimental and control groups (Figure 7). No significant differences were detected between experimental and control groups among English-speaking participants. Hispanics maintained higher scores in the post-test, but with no difference between control and experimental groups. There was a significant difference between control and experimental groups among supervisors and American workers in the post-test. Experimental groups had a significant improvement in their proficiency in speaking Spanish, in comparison with the control group. English speakers did not learn new words in the control group, whereas Spanish speakers in the control group had some development in communication without the TICHA training. Nevertheless, TICHA significantly accelerated Hispanic workers' learning rate.

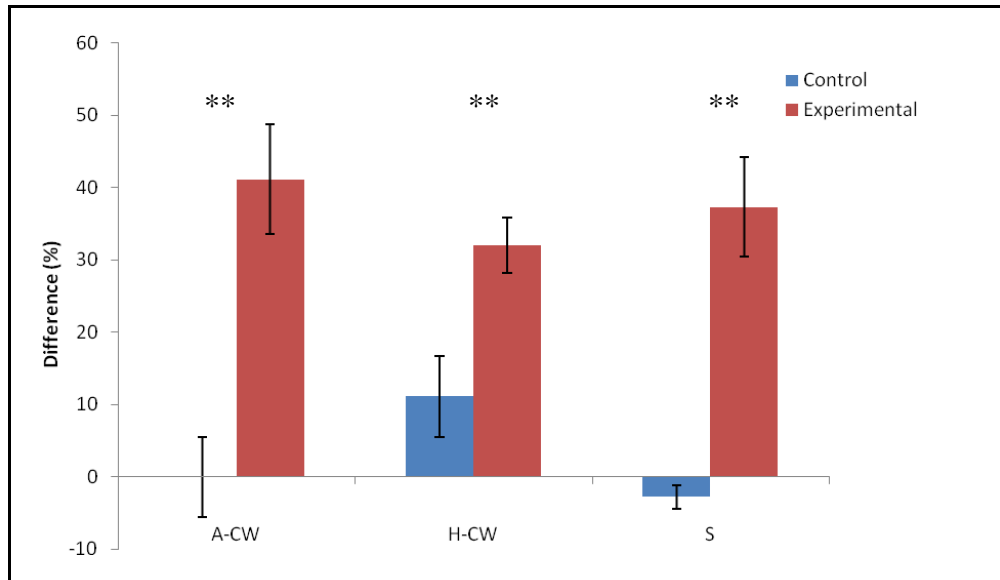


Figure 7. Test score difference (in percentage) between pre- and post-tests for control and experimental groups

Note: Workers were grouped by position within the crew.
 Grouped bars marked were significantly different (** $p < 0.01$).

4.3. TICHA Training Effectiveness on Communication

At the start of this project, it was not clear whether the research methodology implemented for the experimental design was going to yield results. A “backup” set of questions were asked in order to quantify the participants’ perceptions of their ability to communicate with the supervisor and ask questions before and after the TICHA delivery. The positive results support the appropriateness of the research methodology.

Figure 8 shows the response of the participants to their perception of the ability to communicate with the supervisor before and after the training; we found this varies between ethnic groups. Similar to the results from the language test, the experimental group showed a higher change in their confidence to speak in another language than the control group. The change was similar between American and Hispanic participants, suggesting that the whole crew in general improved significantly in their ability to communicate in another language.

The perception of confidence to ask questions was highly influential among Hispanics in the experimental group in comparison with the control group. In contrast, American workers showed a higher confidence independent of the training. The fact that most questions are directed to the supervisor and in English most likely explains the lack of differences between control and experimental American workers.

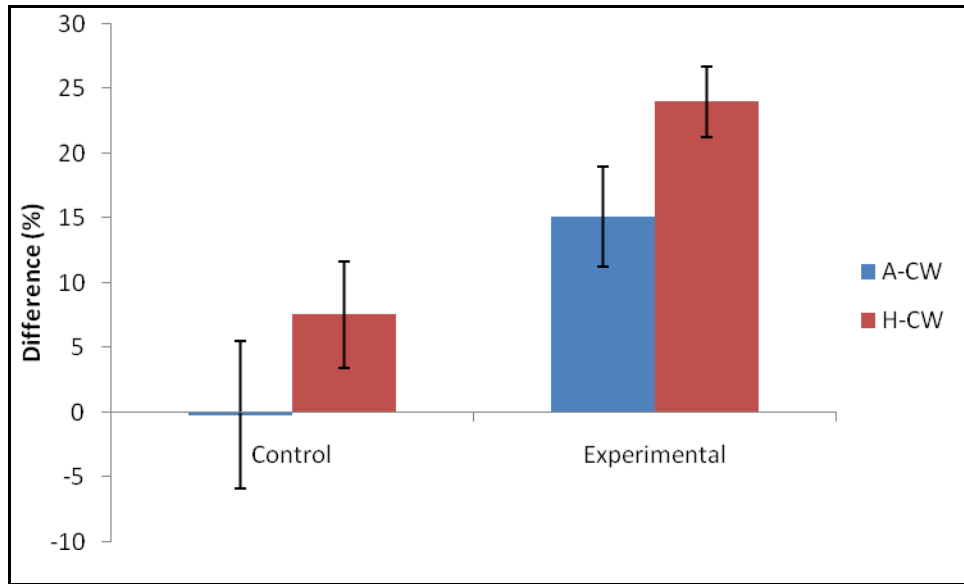


Figure 8. Difference (in percentage) between American and Hispanic workers in their perception of communication skills before and after TICHA training

Figure 9 depicts the results of the training evaluation. Hispanics valued the training materials and the content, in terms of vocabulary and sentences, significantly more than American workers. As expected, Hispanics were significantly more eager to receive training the following year than were their American counterparts. The most likely reason for this is that the Hispanic workers desire to learn construction terminology in English that would allow them to integrate into the crew more effectively. On the other hand, it is quite noticeable that both Hispanic and American workers graded the “interaction” component of the training as the most helpful of all. This is the only aspect of the course that Americans graded higher than Hispanics on the evaluation.

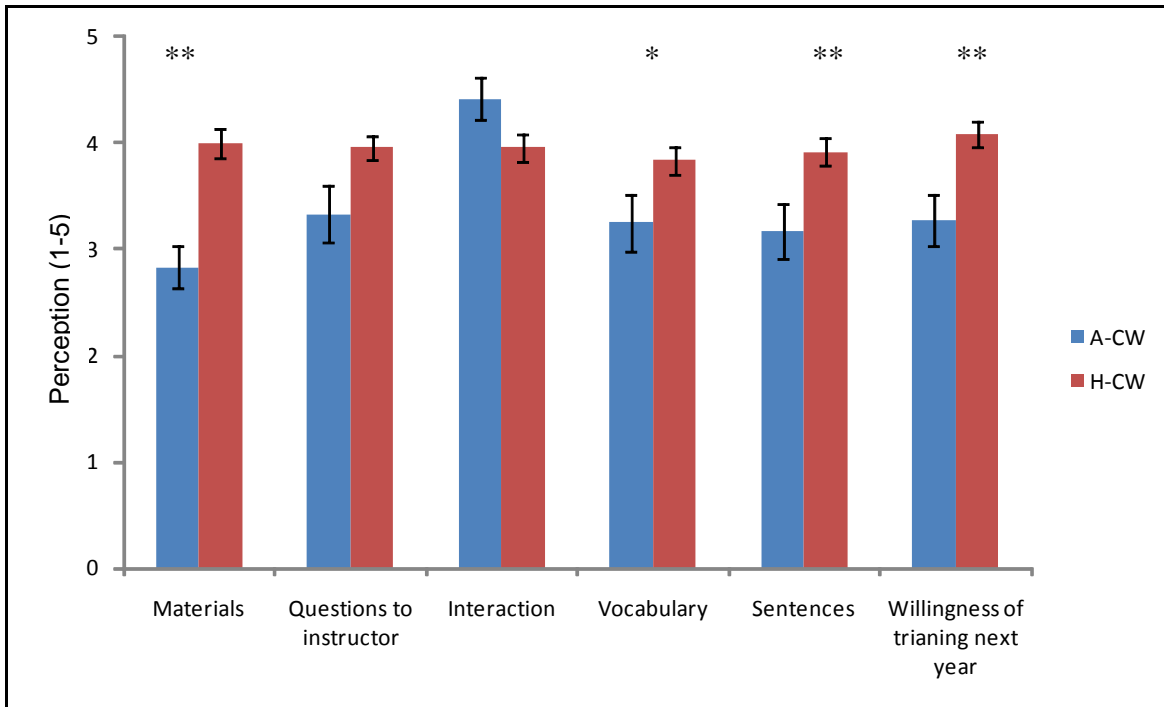


Figure 9. Perception of TICHA components by American and Hispanic workers

Note: Groped bars marked were categories rated significantly different between groups (* $p < 0.05$; ** $p < 0.01$).

Figure 10 shows crew members' perception of the impact of the class on their daily activities. Hispanics considered the morning class session beneficial in terms of "cheering up" the day. However, American workers rated this session lower. In contrast, American workers considered the class duration (30 min) more positively than the Hispanics, who usually desired more time per session and additional reviewing sessions. Both groups considered the training helpful for improving daily communication and, consequently, productivity on the jobsite. In accordance with this perception, they did not consider the morning class as interfering with their daily activities.

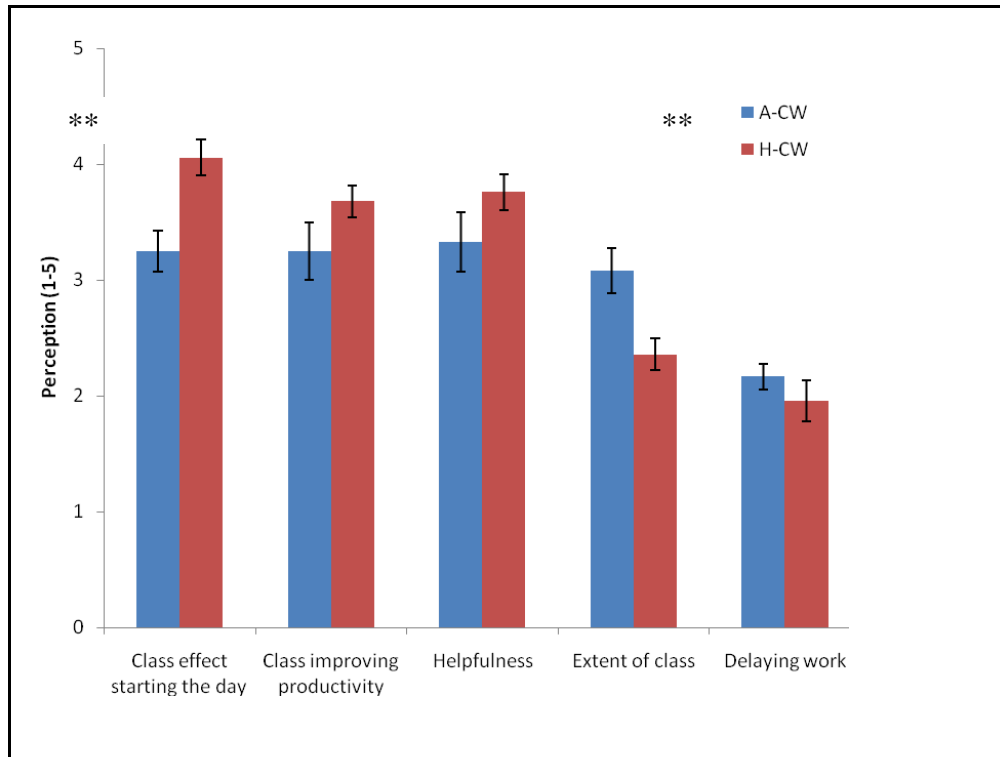


Figure 10. Perception of TICHA impact on daily activities during the delivery of the modules by American and Hispanic workers

Note: Groped bars marked were categories rated significantly different between groups (** $p < 0.01$).

Figure 11 summarizes the supervisors' perception of major traits related to worker productivity and quality. Effectiveness refers to the employees' attitudes toward work tasks in terms of punctuality, respect, and cooperativeness. Functionality relates to the adequate use of materials, work performance, and initiative of the workers. Productivity considers the diligence and efficiency of workers in performing tasks, and time use relies on the use of time in finishing tasks. Supervisors presented better evaluations for Hispanic workers than their American counterparts; these differences were more evident for effectiveness and productivity, whereas evaluations were similar for functionality and time use.

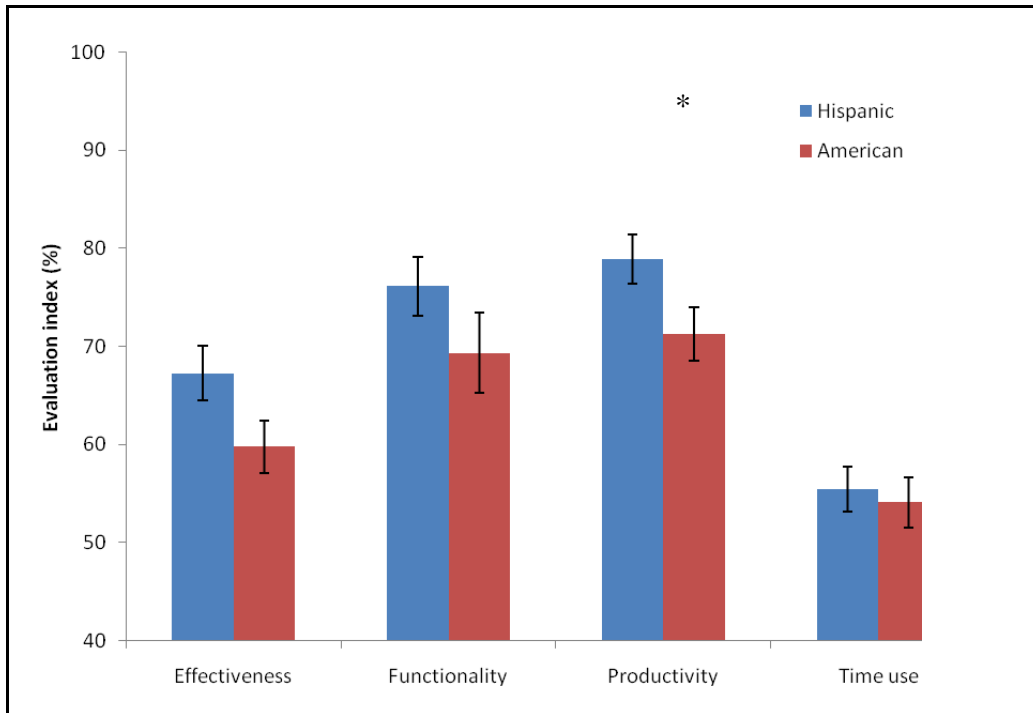


Figure 11. Supervisor's evaluation of work performance by American and Hispanic workers in their crews

Note: Grouped bars marked were categories rated significantly different between groups (* $p < 0.05$).

As depicted in Figure 12, the perception of conflicts is fairly similar among workers. In general, language and communication problems were rated as the most frequent reason for conflict among peers. This problem was highlighted by Hispanic workers, who may find this limitation as the most significant barrier in the workplace. Personal friction and task conflicts were rated similarly among workers. Finally, the frequency of problems caused by unsafe behavior was generally perceived as low, suggesting that safety practices are rarely a reason for disagreements among workers.

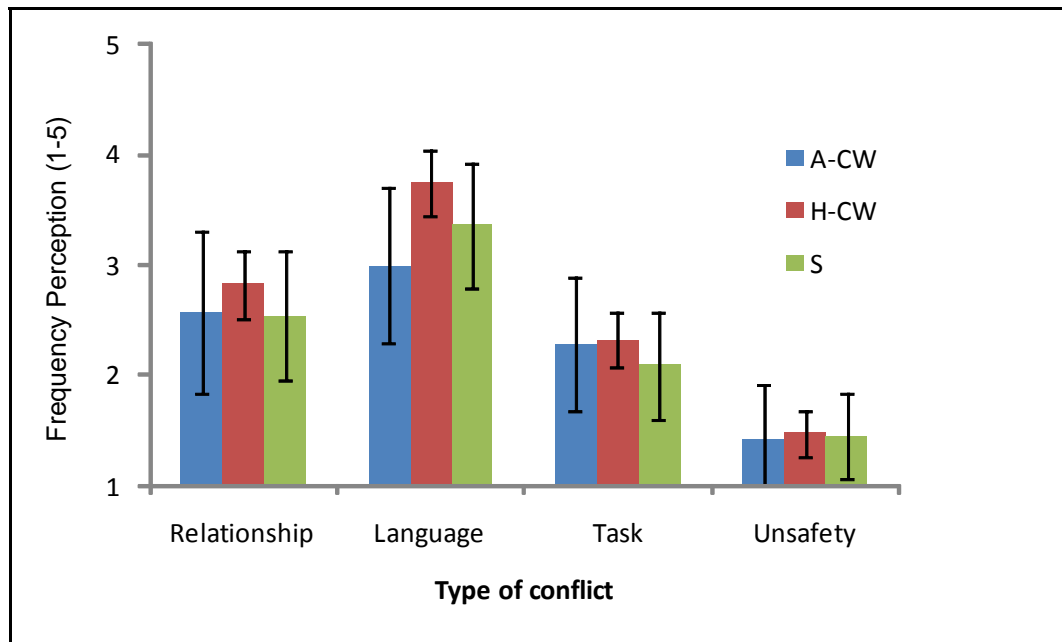


Figure 12. Frequency of different type of conflicts among workers on the jobsite

Conflict resolution strategies varied among workers depending on ethnicity and position in the crew (Figure 13). In general, compromising and negotiation strategies were highly rated for all participants, suggesting that these strategies are well accepted among peers as a way to solve conflicts. However, supervisors also rated forcing (i.e., not reaching compromise or negotiation) as a plausible way to solve conflicts. In fact, this strategy was preferred over compromising, suggesting that supervisors tended to impose their ideas rather having an open dialogue among peers. In contrast, neither Hispanic nor American workers considered the forcing approach as a better solution than negotiation or compromising strategies, suggesting that they might have a yielding attitude toward the supervisor. The avoiding approach also showed remarkable differences among groups. Hispanics highlighted this approach as acceptable, whereas the supervisors rarely considered this approach as a viable way to solve problems. It is possible that the immigrant condition of most Hispanic workers influences their decision to stay out of problems, whereas the supervisors feel the urgency to solve problems due to their leadership position in the crew.

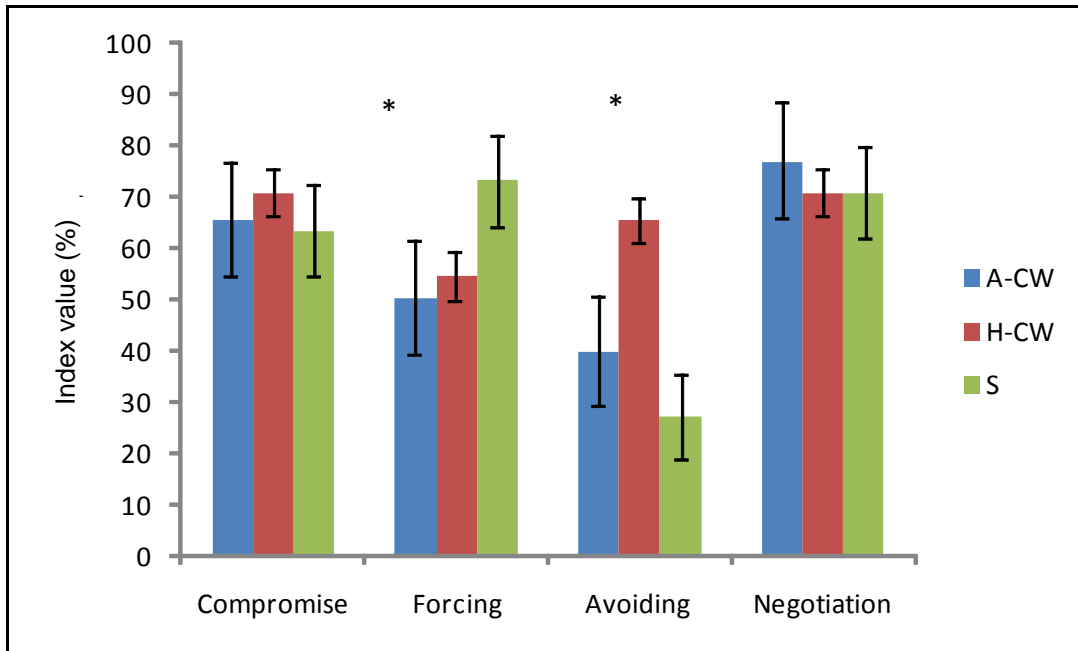


Figure 13. Preference of different strategies to solve conflicts among workers according to their position in the crew

Note: Grouped bars marked were categories rated significantly different between groups (* $p < 0.05$).

5. SUMMARY OF FINDINGS

The problem addressed in Phase IV of this research project involved developing a better understanding of the impact of the HWRP training on improving the productivity and safety of transportation construction projects. Documenting the benefits of this training provided more conclusive evidence related to the value of communication on construction jobsites. In addition, this project provided an opportunity to train a large number of workers in order to see aggregate improvements in the Iowa construction industry.

While the research team conducted the study using TICHA training, basic ESL and SSL training, as needed by Iowa contractors, were also delivered throughout the year and half of the project duration. In addition, one train-the-trainer course was provided to a bilingual Hispanic craft worker of Elder Corporation. Ideally, the same study conducted in Phase IV should be conducted but under the instruction of the bilingual Hispanic craft worker—a link person—who has taken the train-the-trainer approach. An additional study would measure the effectiveness of TICHA when taught by a link person.

This study also revealed the cultural and conflict experiences of multicultural construction crews. The study shows that TICHA increased the flow of communication between cultural groups. In addition, the groups that were exposed to TICHA learned a significant number of words and phrases that are useful in the construction industry.

6. CONCLUSIONS AND RECOMMENDATIONS

Several benefits resulted from this project. A key benefit of this study is that it provides quantifiable results showing the value of the TICHA training, which is of primary interest to contractors, the Iowa DOT, and possibly insurance companies. As a result of the training, American supervisors and Hispanic workers are also better trained employees, which, in turn, will

- reduce cross-culture conflicts,
- avoid costly employee errors,
- decrease employee turnover, increase worker productivity and morale,
- improve trust between Hispanic workers and management,
- reduce accidents, and
- enhance quality.

It is expected that continuous integration education for multicultural crews will result in crews that work more productively and safely, and produce higher quality construction projects.

The research team recommends the formalization of a multicultural training program. The main customers for this type of program would be those in the private sector who can organize the funding structure for such a program through trade associations, such as the Associate General Contractors and Masters Builders of Iowa. So far, the HWRP has operated at the Center for Transportation Research & Education (CTRE) at Iowa State University. The program proposed in this report could form synergies with other outreach programs based at CTRE, such as the Local Technical Assistance Program (LTAP) and the Construction Pavement and Technology Program (CP Tech Center). In addition, while the bulk of the research could take place at CTRE, the training frontiers could go beyond the state of Iowa with the collaboration of other outreach centers at other universities.

The Iowa DOT and the Federal Highway Administration have funded the HWRP since its beginnings. While one of the many objectives for providing funding for research is to produce findings that improve the competitiveness of construction companies, many of the concerns of these government entities have to do with how unprepared society is for the projected increase of Hispanics joining the construction season. This demographic change in the industry affects the process and quality of building the safe and high-quality roads that taxpayers demand.

In summary, the creation of the program suggested in this document will assist all the players in the construction industry in maintaining safety standards despite rapid changes in its labor force. The funding for creating the suggested program should come from the beneficiaries. That is, industry and government should reach an agreement for the funding of a program with the mentioned characteristics.

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