Andragogy as a Tool to Transform Construction Management Students' Conflict Management Styles

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A common reason for Integrated Project Delivery (IPD) failures is that some construction managers struggled to adjust to IPD's environment. IPD demands collaborative conflict management. The Thomas-Kilmann Conflict Mode Instrument (TKI) indicates that construction management (CM) students' conflict management styles tend to be non-cooperative. An inability of a CM student to be collaborative may impede their competitiveness. Students in a CM program at Central Washington University (CWU) were exposed to conflict management through andragogical methods. Methods included active learning games and conflict-infused assignments. This study evaluated how conflict management styles evolved. The Avoiding, Compromising, and Collaborating styles showed significant differences.

Keywords: andragogy, conflict management, collaboration, active learning

INTRODUCTION

Market forces within the construction industry are demanding more collaborative environments. Construction Management at Risk, Design/Build, Lean Construction, and Integrated Project Delivery (IPD), now account for most of all construction contracts (AIA, 2007). In particular, IPD requires a significant level of collaboration to succeed. However, these increasingly collaborative project delivery systems do not ensure collaboration. For example, Lean Construction proponents frequently employ the principles of IPD and have positively impacted the construction industry, but success does not occur on every project. In fact, several opponents named Lean Construction as "mean construction" as evidenced by the November 21, 2007 cover story of Engineering News Record entitled "Lean Without Mean" (Post, 2007). The reasons for failures are considerable, but a common theme that emerged was that the construction managers selected for these projects had difficulty adjusting their mindsets to operate in a collaborative framework and struggled to manage conflict in a cooperative manner. Typically, individuals with a strong record of success on previous projects were selected to manage these collaborative projects in the hope that they would achieve even more successful IPD projects. However, due to the habits that were ingrained into them from years of experience, they instead exhibited non-cooperative behavior. The author asserted that these individuals thought that collaborative behavior indicated weakness. As these convictions revealed themselves on projects, expectations were diminished, and distrust then ensued. Consequently, this distrust among project participants eventually led to poor communication, unfruitful conflict, and reduced performance. Many members of the construction industry understand this dilemma and attribute the problem to an unwillingness on the part of the project participants to behave in a collaborative manner and this gives a starting point for research regarding how to promote more

collaborative attitudes among construction participants within the construction industry (Rowings, et.al., 1996).

BACKGROUND

In 1607, Sir John Ratcliffe, Captain John Smith, and a host of financial investors established the first settlement in the New World known as Jamestown. Disease, starvation, and a lack of cooperation between the elite class and commoners, soon ravaged the settlement and nearly decimated the entire population of Jamestown in the first year. Shortly thereafter in 1620, William Bradford and a few agrarian, unskilled, poor, religious fanatics landed on Plymouth Rock (Marshall & Manuel, 1977). Despite facing many of the same trials as Jamestown, the Plymouth Rock experiment withstood them and established the first enduring settlement in the New World. The Jamestown and Plymouth Rock experiments envisioned similar goals of founding a presence in the New World; however, stark contrasts delineate their efforts. For the Jamestown experiment, contractual relationships were devised in the form of a joint stock corporation between the settlers and the Virginia Company of London to protect individual interests for any wealth, such as gold, pearls, etc., discovered while in the New World. Many of the Jamestown settlers were of noble blood, and based on their self-perceived importance, they expected to be catered to by the craftspeople (i.e. carpenters, fishermen, masons, laborers, etc.) who were not considered Gentlemen. Unlike the Jamestown settlers, the Plymouth Rock Pilgrims understood that everyone's skills (including women) and talents were vital to the survival of the group and that the survival of the group was vital to individual prosperity. Consequently, in lieu of employing contracts that focused on protecting everyone's rights, the Pilgrims drafted the Mayflower Compact imploring:

> ... [we] constitute and frame such just and equal laws, ordinances, acts, constitutions and offices from time to time, as shall be thought most meet and convenient for the general good of the colony. Unto which we promise all due submission and obedience (Marshall & Manuel, 1977).

The Mayflower Compact was then agreed upon by all Plymouth Rock settlers and thus, began the first truly American collaborative experiment.

Many relationships within the construction industry emulate the Jamestown scenario. Inherent distrust among the project participants leads to poor communication, unproductive conflict, and reduced performance and the extent of litigation in the construction industry illustrates the level of distrust. At the same time, market forces are demanding significant performance improvements. Collaborative project delivery systems now account for more than 50 percent of all construction projects as compared to 10-15 percent twenty years ago (Martin & Plugge, 2015). However, these collaborative project delivery systems alone do not ensure long term, sustainable collaboration. Increasingly, the amount of litigation in the area of Design-Build signals an underlying difficulty in establishing true collaborations within the context of contractually organized and controlled delivery methods. Despite the integration of more collaborative contracts into IPD projects, successful projects have not always been achieved either. To further complicate the issue is that in addition to the typical uncooperative construction managers that continue to manage the same way that they were conditioned through other methods, there is evidence that the construction industry attracts individuals that tend to be uncooperative (Martin & Plugge, 2015).

In the end, a successful IPD project needs more than just a properly written contract or enhanced technology. It requires the project participants to act in a collaborative manner during conflicts, negotiations, and operational procedures. Therefore, entrants, as well as, veterans in the construction industry are required to be adept at managing conflict collaboratively in an IPD project. Arguably, adjusting these mindsets could solve the "mean" problem referred to previously. However, mindsets are not easily altered, because they are generally embedded in an individual's psyche either through a lifetime of conditioning or through personality, or both. In order to effect change in the way an individual thinks, they need to understand the benefits associated with cooperative behavior. To accomplish this result, two

andragogical active learning exercises known as *Prisoner's Dilemma* and the *$20 Negotiation Game* were employed at CWU in the CM program that encouraged these students to reconsider the values and recognize the need associated with collaboration. In addition, at various points throughout a student's tenure in the CM program at CWU, other course-related projects and assignments, designed to promote the value of teamwork and collaborative behavior were also used to influence the students' mindsets. The active learning games marked a seminal, culminating moment in the students' journey toward a more collaborative mindset. In part, the result of this research determined whether the students' abilities and attitudes toward collaboration were altered during their tenure in the CM program as measured through the Thomas-Kilmann Conflict Mode Instrument (TKI).

PURPOSE OF THE STUDY

The purpose of this study was to evaluate the effectiveness of CWU's CM program's professors in producing more collaborative leaders to better serve the construction industry and to prepare the students for an evolving industry. This paper also provides follow-up to a previous conference paper that was used to provide construction educators insight into andragogical methods used to reinforce IPD collaboration principles. The conclusions presented in the conference paper indicated that CM students at CWU tended to be non-cooperative in conflict scenarios (Martin & Plugge, 2015).

In the original pilot study, it was established that as a group, the CM students at CWU varied from the general population, as well as several other industries, regarding conflict management styles (Martin & Plugge, 2015). Although informative, it was not conclusive as each graduating class had its own set of norms and its own personality that develops over time. It was possible that these results differed from one year to the next. In addition, it was not determined whether these students' styles changed while they were enrolled in the program. Additional research was required to determine whether the CWU CM program was preparing students to enter an industry that was changing culturally toward collaboration.

LITERATURE REVIEW

The foundations of IPD were established by modifying the structure of organizational relationships and operational procedures, between project participants to encourage collaboration. However, any society is defined not just by its structure, but also by its culture (Kanagy & Kraybill, 1999). Therein lies much of the struggle in successfully implementing IPD on a consistent basis. It is generally accepted that construction is a competitive business and breeds competitiveness. For IPD to truly work to its fullest potential, the culture needs to change toward collaboration along with the structure. Cultures are always changing and adjusting with each passing generation. Therefore, adjusting the construction industry culture can best be accomplished by effecting this change within the mindsets of the newest generation of construction managers. Several construction management programs at universities across the United States attempt to incorporate IPD lessons into their curriculum. However, few focus on developing more collaborative attitudes with a few notable exceptions. Carter, et.al, (2018) at the University of North Carolina at Charlotte, proposed new methods for teaching students how to function in teams in order to prepare students for working in the construction industry. The results showed that a one-time teamwork training intervention did not impact student's attitudes and behaviors about teamwork. However, instead of using a snapshot, one-time, method, another study added the element of time by reviewing team performances to accomplish a semester long project. The study consisted of 53, four to five-person student teams. The study indicated that proper management of relationships and task conflicts had a positive effect on team cohesion and that team cohesion had a positive relationship to team performance, thereby, a positive relationship existed between proper conflict management and team performance (Tekleab, et.al, 2009). Therefore, in contrast to Carter et al.'s approach to employing a one-time event, the researcher at CWU attempted to employ andragogical methods to the entire curriculum through the use of conflict-infused projects over a period of time, as well as, a seminal, one-time event in the students' senior year that promoted and effected change

toward collaboration in the minds of the students in the construction management program since the 2014-2015 academic year.

Andragogy

Malcolm Knowles, the recognized leader in adult education philosophy, termed the art and science of the learning process of adults as andragogy (Gibbons & Wentworth, 2001). In his seminal work, entitled *Modern Practice of Adult Education*, Knowles changed how adult learning is perceived. He posited that children learn best through pedagogy or "teacher-centered" instruction, where the emphasis is on lectures filled with the lecturer's knowledge-based materials and the learning was accomplished through rote memorization and simplistic applications. In addition, he also asserted that adults learn best through andragogy or "learner-centered" instruction, where the emphasis is on tapping into the learners' knowledge-base and the learning is accomplished through experiential-based, related applications. Due to Knowles' studies, pedagogy came with the connotations of learning environments where students passively learn while educators fill their minds with knowledge through lectures, textbooks, and exams. Andragogy then became synonymous with learning environments where students actively learn while educators facilitate experiences through hands-on, informal, and interactive instruction based on relevant learning needs and knowledge is then acquired primarily through their own efforts (Bowman, 2007).

Knowles (1970) suggests that the classroom climate should be one of "adultness." Since adults manage other aspects of their life, they can manage their own learning and are consequently capable of developing a readiness to learn. Therefore, their learning development is geared toward being task and problem-centered, motivated by internal incentives and curiosity, and relevant to their needs (Merriam, 2001). In a classroom of young adults whose life experiences and needs are just beginning to develop, further experiences and intellectual curiosity should be cultivated for the learners to understand why the knowledge being disseminated by the educator is relevant to their needs (Gitterman, 2004). Active learning, in the form of course-long role playing, socially interactive assignments, and active learning games aid in developing and creating these experiences (Cornelius, et. al., 2011). In an effort to provide further experiences to the young adults in the CWU CM program, professors embedded active learning methods into the construction curriculum starting in the junior year and proceeded on through the end of their senior year. These active learning methods included projects that required students to act the part of typical construction participants (i.e. architect, owner, contractor, etc.) with opposing agendas. Other methods included active learning games designed to address conflict and negotiation tactics such as *Prisoner's Dilemma* and the *$20 Game*.

Active Learning

"We learn an art or craft by doing the things that we shall have to do when we have learnt it" (Aristotle). Active learning has been implemented in several different forms to expose students to various subjects in construction. The idea of active learning was first established through the works of John Dewey, where he defined experiential learning through "adaptive modes of concrete experiences and abstract conceptualizations and the modes of active experimentation and reflective observation characteristically resolved in different fields of inquiry" (Kolb, 1984). Kolb states that there are two main goals in the experiential learning or active learning process which include learning the "specifics of a subject and to learn about one's own strengths and weaknesses as a learner-learning how to learn from experience" (Kolb, 1976, p. 22).

With construction education, it is very difficult to take experiences commonly found in the ebb and flow of the construction field and simulate them in an academic setting. Gier and Hurd (2004) investigated different approaches to active learning to enhance student engagement in the classroom. They suggested when students were engaged in real world scenarios, they were more actively engaged in learning the concepts being taught. Similarly, Sims & Serbrenia stated that an experiential approach addresses three challenges in diversity education, "providing a holistic education, the dilemma of individualism and equality in the classroom, and providing a safe climate. The dual knowledge theory of experiential learning theory depicts learning as an integrated process that attends to what learners think as well as what they feel, perceive, and do" (Sims & Serbrenia, 1995).

Construction management researchers explored the ideas of active learning in different forms including interactive games to demonstrate construction management concepts. It was found that construction management students learn differently than other disciplines. Stein and Gotts (2001) found through a Meyers Briggs survey questionnaire of 73 undergraduate construction management students that 75 percent of the students have a sensing/judging temperament and students like to reach conclusions through a step-by-step process and like to put what they have learned to use. Most importantly, it was found that 67 percent of the students preferred hands-on or activity-based learning. Researchers also found that construction management students are kinesthetic learners, who prefer to learn by doing, as opposed to listening to a lecture (Bray & Manry, 2007), (Carns & Plugge, 2010).

Due to the effectiveness of active learning for construction management students, active learning models were used to teach many concepts in construction management. Most recently, Reyes and Johnston (2018) at the University of Oklahoma used active learning games to convey basic concepts in a surveying course. Through observations and categorizing responses, the researchers discovered that student engagement inside and outside of class sessions increased from those observed in previous years due to active learning games. One example included students earning points through accomplishing tasks that required the students to learn specific course objectives. The more points earned, the higher the student's rank in the class. Students were observed attempting to discover and create additional ways to earn points, beyond the course objectives, to win the game inside and outside of class. These were actions that never had an opportunity to materialize in previous years. Although qualitative in nature, the study also showed that the use of games yielded higher scores on the final exams and assignments.

Herrmann, et.al., (2016) at Mississippi State University performed a qualitative study on IPD collaboration between mixed disciplines in a senior level design competition. Near the end of the competition, a series of questions were issued to each participant. The responses to these questions were then categorized to ascertain how students perceived the most essential attributes for a successful senior project. The questionnaires revealed two common themes to be the most important. First, open communication followed by collaboration as being critical to perform well and eliminate wasted time and effort.

In addition, Shim, et.al., (2013) used a simulation game using Legos® to create Line of Balance schedules to understand the implications of batch sizing for schedule control. The researchers observed three cycles of the students creating Lego® products. Each cycle came with its own constraints ultimately affecting the efficiency of the process. It was found that when students were allowed to communicate, efficiency improved.

In an earlier study, Bray and Manry (2007) used a hands-on model to demonstrate active learning in a concrete design class. They found students "enjoyed the opportunity to do a hands-on project and were more willing to concentrate on design issues presented in a construction management context." Carns and Plugge (2010) used a working model of a heat pump to demonstrate the refrigeration cycle. Their statistics showed through the use of a hands-on active learning model that there was some association between perceived knowledge and actual knowledge when the model was used. Furthermore, the use of a model demonstrated that construction management students are active learners who gain comprehension of more complex concepts, such as mechanical systems, as visual hands-on learners.

Active Learning Games

The first activity-based game that was introduced to the students was Prisoner's Dilemma. This game theory was originally framed by Merrill Flood and Melvin Dresher in 1950 and was formalized by Albert W Tucker in 1992 (Poundstone, 1992). Prisoner's Dilemma illustrates why two individuals might not cooperate, even if it appears that it is in their best interest to do so. The purpose of the game is to show that purely rational self-interested persons will betray another if it appears that betrayal yields a greater reward than cooperation.

The second activity-based game was the $20 Negotiation Game. This is an adaptation to the $2 Game that was first developed by Rowe which is a simulation game to demonstrate win/lose bargaining and negotiation tactics and conflict management styles (Rowe, 2001). The purpose of the game is to get students

to develop their skills in negotiation and conflict management. Through playing the game students take time through the activity to negotiate the process of getting $20 from their fellow classmate given a set of instructions. The importance of the game is that it illustrates the basic tools that are necessary in negotiation theory.

At the end of each game there was a debriefing session to discuss the concepts of negotiation and conflict management. In addition to the debriefing sessions, students were then provided a questionnaire which allows the students to answer some specific questions about the games and reflect on what they learned in the process. The central point of the games is to illustrate the basic concepts of collaboration and negotiation in an activity-based demonstration.

Conflict Management Styles

The TKI is a method to determine an individual's behavior in conflict situations. Conflict situations are the situations in which two people's concerns appear to be contradictory. In these situations, a person's behavior can be plotted along two simple dimensions: (1) assertiveness, the magnitude to which a person endeavors to satisfy one's own concerns, and (2) cooperativeness, the magnitude to which a person attempts to gratify the other person's concerns. These two basic dimensions of behavior can be used to determine which of the five conflict management styles an individual employs when dealing with conflicts.

All five styles are appropriate in specific situations and each represents a set of useful social skills. For example, the adage that "two heads are better than one" (Collaborating) is frequently considered valuable when solving complex problems. However, "Kill your enemies with kindness" (Accommodating) is also frequently considered appropriate in times of organizational healing. "Split the difference" (Compromising), "Leave well enough alone" (Avoiding), or "Might makes right" (Competing) all have their place and usefulness at specific times. The practicality of a particular conflict management style varies with the needs of the specific conflict situation. These five conflict-handling modes are shown in Figure 1:

FIGURE 1
THOMAS-KILMANN CONFLICT-HANDLING STYLES (Psychometrics.com)

Following are brief descriptions of each style (Herck, et.al, 2011).

Competing is assertive and uncooperative. An individual pursues his own concerns at the other person's expense. This is power-oriented mode, in which one uses whatever power seems appropriate to win one's own position.

Accommodating is unassertive and cooperative. This is the opposite of competing. When accommodating, an individual neglects his own concerns to satisfy the concerns of the other person.

Avoiding is unassertive and uncooperative. The individual does not immediately pursue his own concerns or those of the other person. Avoiding might take the form of diplomatically sidestepping an issue, postponing an issue until a better time or simply withdrawing from a threatening situation.

Collaborating is both assertive and cooperative. This is the opposite of avoiding. Collaborating involves an attempt to work with the other person to find some solution which fully satisfies the concerns of both persons.

Compromising is intermediate in both assertiveness and cooperativeness. The objective is to find a mutually acceptable solution that partially satisfies both.

Everybody has the ability to use all five conflict styles and no one can be categorized as having a single style of managing conflict. However, all individuals apply some styles better than others and therefore, is inclined to rely upon those styles more habitually. The challenge for IPD participants is to learn how to acclimate to more cooperative styles because the situation of an IPD project requires it for success.1

METHODOLOGY

This quantitative, descriptive study identified the conflict management styles of the CWU CM students when they entered the CM program at CWU and compared it with their conflict management styles near the completion of the program, after the *Prisoner's Dilemma and $20 Game,* as well as several conflict-infused scenarios, and other andragogical exercises. The research determined the trends of the students' changing conflict management styles from their junior to their senior year.

Since the initial pilot study, in 2015, this researcher continued to gather additional data and changed the timing of when the TKI was administered (Martin & Plugge, 2015). Specifically, the TKI was administered during the first course in the program (CMGT343 – Estimating I), taken during their junior year and then again in another course (CMGT455 – Construction Project Management), when the students were nearing completion of their degrees. By this time, the students were engaged in many of the andragogical activities discussed earlier. These activities were often scenarios found on construction projects that generally have opposing agendas. Scenarios were included in the project as challenging questions to help illustrate the importance and value of each team member's position. These included role-playing negotiations, client relationship management, and the two active-learning games. All of these were designed to expose non-productive conflict to encourage the students to consider alternative, collaborative attitudes for managing construction projects from an inter-personal relationship perspective.

Since this study compared conflict management styles of the same students pre-program and post-program, the researcher employed a causal-comparative analysis to detect changes in the students' conflict management styles while enrolled in CWU's four-year, campus based, American Council for Construction Education (ACCE) accredited CM program (Spatz, 2007). These comparisons helped the researcher to assess the effectiveness in producing more collaborative students. The results of the TKI were evaluated through a series of statistical tests. TKI paper-based questionnaires were distributed to 53 juniors over a four-year period for the three graduating classes of 2016, 2017, and 2019. In addition, another 53 questionnaires were distributed to the identical students while they were seniors. The TKI scores were tallied and documented in order to determine each student's conflict management style during their junior and senior years and then used to evaluate the changes in styles, as a collective student group.

To accomplish this effort, five independent samples one-tailed t-tests were performed for each TKI conflict style. First, the scores for the 53 juniors were compared against the tallied scores of the 53 seniors for the "Competing" dimension from the TKI. Following that comparison, each of the four other dimensions were evaluated using the same approach.

RESULTS

The results of the paired samples *t*-test as shown in Table 1 determined that the junior Competing raw scores ($M = 6.13$) were not significantly different from the senior Competing raw scores ($M = 5.72$), ($t[52] = 1.360, p > 0.05$).

TABLE 1
PAIRED SAMPLES *t*-TEST OF "COMPETING" MEANS: JUNIORS V. SENIORS

Competing

	Junior	Senior
Mean	6.132075472	5.716981132
Variance	7.309143687	6.783744557
Observations	53	53
Pearson Correlation	0.649936893	
Hypothesized Mean Difference	0	
df	52	
t Stat	1.359663626	
P(T<=t) one-tail	*0.08990157*	
t Critical one-tail	1.674689154	
P(T<=t) two-tail	0.17980314	
t Critical two-tail	2.006646805	

The results of the paired samples *t*-test shown in Table 2 indicated that the junior Collaborating raw scores ($M = 5.49$) were significantly different than senior Collaborating raw scores ($M = 6.17$), ($t[52] = -2.164, p < 0.05$).

TABLE 2
PAIRED SAMPLES *t*-TEST OF "COLLABORATING" MEANS: JUNIORS V. SENIORS

Collaborating

	Junior	Senior
Mean	5.490566038	6.169811321
Variance	3.754716981	5.605224964
Observations	53	53
Pearson Correlation	0.450985805	
Hypothesized Mean Difference	0	
Df	52	
t Stat	-2.163931941	
P(T<=t) one-tail	*0.017542497*	
t Critical one-tail	1.674689154	
P(T<=t) two-tail	0.035084994	
t Critical two-tail	2.006646805	

The results of the paired samples *t*-test shown in Table 3 indicate that the junior Compromising raw scores ($M = 7.02$) were significantly different than senior Compromising raw scores ($M = 7.58$), ($t[52] = -2.272, p < 0.05$).

TABLE 3
PAIRED SAMPLES t-TEST OF "COMPROMISING" MEANS: JUNIORS V. SENIORS

Compromising

	Junior	Senior
Mean	7.018867925	7.58490566
Variance	3.13425254	3.247460087
Observations	53	53
Pearson Correlation	0.484724898	
Hypothesized Mean Difference	0	
df	52	
t Stat	-2.272285924	
P(T<=t) one-tail	*0.013616259*	
t Critical one-tail	1.674689154	
P(T<=t) two-tail	0.027232519	
t Critical two-tail	2.006646805	

The results of the paired samples *t*-test in Table 4 indicate the junior Avoiding raw scores ($M = 6.72$) were significantly different than senior Avoiding raw scores ($M = 5.77$), ($t[52] = 2.935, p < 0.01$).

TABLE 4
PAIRED SAMPLES t-TEST OF "AVOIDING" MEANS: JUNIORS V. SENIORS

Avoiding

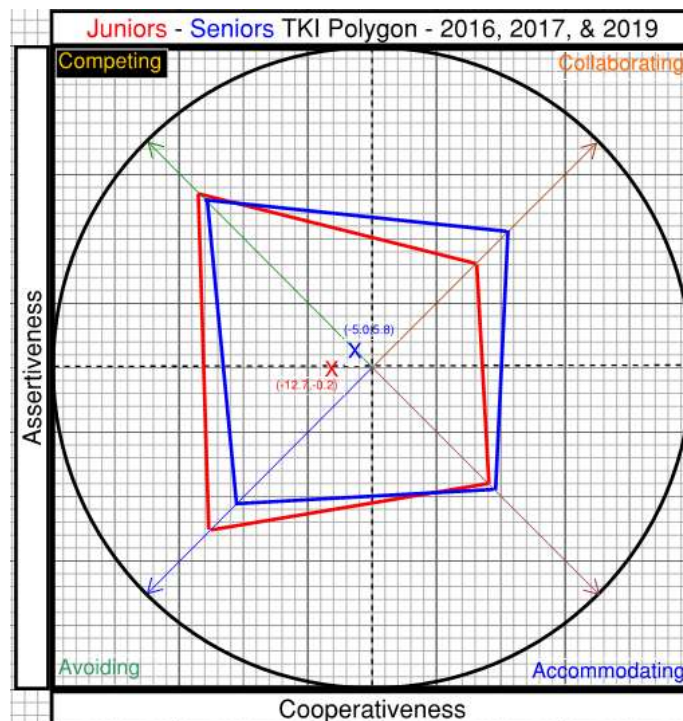|	Junior	Senior
Mean	6.716981132	5.773584906
Variance	4.091436865	4.870827286
Observations	53	53
Pearson Correlation	0.390304583	
Hypothesized Mean Difference	0	
df	52	
t Stat	2.934544723	
P(T<=t) one-tail	*0.002480909*	
t Critical one-tail	1.674689154	
P(T<=t) two-tail	0.004961819	
t Critical two-tail	2.006646805	

The results of the paired samples *t*-test in Table 5 indicate the junior Accommodating raw scores ($M = 4.66$) were not significantly different than senior Accommodating raw scores ($M = 4.75$), ($t[52] = -0.292, p > 0.05$).

TABLE 5
PAIRED SAMPLES t-TEST OF "ACCOMMODATING" MEANS: JUNIORS V. SENIORS

Accommodating

	Junior	Senior
Mean	4.660377358	4.754716981
Variance	4.959361393	5.227140784
Observations	53	53
Pearson Correlation	0.455454112	
Hypothesized Mean Difference	0	
df	52	
t Stat	-0.291567781	
P(T<=t) one-tail	*0.385888548*	
t Critical one-tail	1.674689154	
P(T<=t) two-tail	0.771777096	
t Critical two-tail	2.006646805	

Using coordinate geometry, a chart was developed with a two-dimensional axis resembling the orientation of the chart shown in Figure 1. The collective results of the styles were plotted against a Cartesian coordinate graph and centroids were located to determine which quadrant the collective juniors and seniors were located. Figure 2 shows the locations for the junior (red) and senior (blue) classes. The juniors and seniors were analyzed using independent samples one-tailed *t*-tests to compare the x and y-coordinate centroids of the two groups.

FIGURE 2
CARTESIAN COORDINATE GRAPH FOR CONFLICT STYLES CENTROIDS

The mean values for each conflict management style for each collective junior and senior groups were plotted on the Cartesian Coordinate Graph (Figure 2) through the use of 45-degree vectors starting from the (0.0, 0.0) coordinates. In Figure 2, a 45-degree vector was plotted in Quadrant 1 (Competing) and the junior Competing mean (M = 78.93) was located on that vector. Using right triangle trigonometry ($a^2 + b^2 = c^2$), the x,y (-55.81, 55.81) coordinates were identified. Next, the senior Competing mean (M = 77.12) yielded (-54.53, 54.53) coordinates. Following the Competing vector, another 45 degree vector was plotted into Quadrant 2 (Collaborating) and the junior Collaborating mean (M = 45.59) yielded an x,y coordinate (32.24, 32.24) and senior mean (M = 60.61) yielded (42.86, 42.86) coordinates. Quadrant 3 (Accommodating) junior mean (M = 51.38) yielded (36.33, -36.33) coordinates while seniors mean (M = 53.63) yielded (37.92, -37.92) coordinates. Finally, Quadrant 4 (Avoiding) junior mean (M = 71.19) yielded (-50.34, -50.34) coordinates while seniors mean (M = 58.36) yielded (-41.27, -41.27) coordinates. Once these coordinates were identified, each point was connected to create the polygons.

In addition, the polygons' respective centroids were determined for each junior and senior student. When all of the centroids were averaged within each junior and senior group, it was determined that the centroid's x,y coordinates for all juniors collectively was (-12.69, 0.19) and for all seniors collectively was (-5.01, 5.47) as presented on Figure 2.

A paired samples t-test was conducted to determine whether there was a significant difference between the junior and senior centroid means. The results of the paired samples t-test shown in Table 6 indicate that the junior centroid x-coordinate mean (M_x = -12.69) was significantly different than the senior centroid x-coordinate mean (M_x = -5.01), (t[52] = -3.739, p < 0.01).

TABLE 6
PAIRED SAMPLES t-TEST OF "CENTROID X-COORDINATE" MEANS:
JUNIORS V. SENIORS

X-Axis (Cooperativeness) Comparison

	Junior	Senior
Mean	-12.68943396	-5.01245283
Variance	276.5291593	299.7900458
Observations	53	53
Pearson Correlation	0.61292796	
Hypothesized Mean Difference	0	
df	52	
t Stat	-3.739563883	
P(T<=t) one-tail	*0.000230287*	
t Critical one-tail	1.674689154	
P(T<=t) two-tail	0.000460573	
t Critical two-tail	2.006646805	

The results of the paired samples t-test on Table 7 indicate that the junior centroid y-coordinate mean (M_y = 0.19) was significantly different than the senior centroid y-coordinate mean (M_y = 5.74), (t[52] = -1.880, p < 0.05).

TABLE 7
PAIRED SAMPLES t-TEST OF "CENTROID Y-COORDINATE" MEANS:
JUNIORS V. SENIORS

Y-Axis (Assertiveness) Comparison

	Junior	Senior
Mean	0.19	5.747924528
Variance	346.6663577	525.8350668
Observations	53	53
Pearson Correlation	0.479284055	
Hypothesized Mean Difference	0	
df	52	
t Stat	-1.879960759	
P(T<=t) one-tail	***0.032860435***	
t Critical one-tail	1.674689154	
P(T<=t) two-tail	0.06572087	
t Critical two-tail	2.006646805	

CONCLUSION AND FUTURE WORK

The results of the independent samples *t*-tests from the junior and senior centroid analysis indicated that the conflict management styles of the CWU CM students moved toward collaboration. As shown in Figure 2, the Collaboration conflict management style is associated with a high level of Cooperativeness (x-axis) and Assertiveness (y-axis). Since the centroid's x-axis and y-axis means associated with seniors both increased from the juniors along a positive slope toward the Collaboration conflict management style, it was determined that the group moved collectively toward Collaboration.

Results obtained from analyzing data collected support the thesis that the andragogical methods employed by the educators in the CWU CM program were successful. In addition, a significant difference existed in three of the conflict management styles including the Collaboration style. Finally, the collective groups' conflict management style gravitated toward the Collaboration conflict management style from the junior to senior years thus, validating the original intent of the curriculum changes to advance collaboration.

Though the study included undergraduate juniors and seniors enrolled full-time in the CWU CM program, the study was limited to three groups from the graduating classes of 2016, 2017, and 2019 for a total of 53 students. This research only included students in the CWU's CM program. The research did not attempt to evaluate the entire university population, nor did it attempt to examine student populations at any other post-secondary institutions. Furthermore, the research did not separate students into any other classification except educational classification. There was no attempt to separate students based upon age, race, gender, nationality or any other characteristic that would individualize the student.

Recommendations for future research include evaluating additional students in CM programs to assess a larger sample population. This would provide a more accurate assessment of conflict management trends among students in CM programs. Future research projects could also consider characteristics of the CM students such as gender, grade point average, or the discipline (heavy-civil versus general) within the CM program the student is enrolled into to determine whether there is any influence of those traits on conflict management styles.

Finally, following up with the current participants after working in the construction industry for four or five years would provide insight into whether the effects of the andragogical methods and lessons learned were enduring. With the solid relationships developed between the CWU researcher and the associated alumni, it is quite possible that these alumni would be willing to complete another TKI. Future research could attempt to determine whether the alumni are impacting collaboration in the industry as well.

SUMMARY

Conflict is a part of everyday life. The way one manages and resolves conflicts is their conflict management style. Depending on the situations, scenarios, and environments certain styles are generally preferred over another. The rising use of collaborative project delivery systems, such as IPD, is causing an increase in collaborations between project partners thus, increasing the need for construction industry affiliates to adopt a more collaborative conflict management style (Post, 2007).

Construction management education programs across the United States are exploring methods to prepare students for the collaborative industry evolution. Many programs are focusing on implementing technological advances that have become common on IPD projects such as Building Information Modeling, cloud-based communication methods, etc. while others are focusing on educating students in the content and nuances of IPD contracts. Both aforementioned areas are appropriate for enabling collaboration, however as Kanagy and Kraybill (1999) assert, in addition to technology and structure, culture is also an integral component of the societal fabric. Since each construction project is its own mini society, cultural impetuses should also be advanced by construction management educators. As alluded to earlier, very little has been accomplished regarding the "culture" arena in IPD construction education. Therefore, educators at CWU embarked upon an effort to effect changes in students' conflict management styles in order to tackle the issues associated with the current construction culture that acts in opposition to the necessary collaborative culture on IPD projects. Through the implementation and use of andragogical methods in the construction curriculum, changes in how students deal with conflict were achieved.

The TKI provided a means of assessing students' conflict management styles. The TKI is the most widely used tool in the arena of conflict management styles. The TKI is an instrument developed to identify the respondent's dominant conflict management style(s). With the advent of collaborative project delivery systems, such as IPD, the traditional methods of conflict management in the construction industry needs to be revisited. Although the dominant conflict management styles of construction industry constituents have yet to be determined, it has been reported that many IPD failures were frequently attributable to project partners' inability to collaborate effectively (Post, 2007). In addition, it was also identified that the Collaboration conflict management styles of CM students at CWU scored well below the U.S. general population by about a two to one margin (Martin & Plugge, 2015). This does not bode well for future IPD projects if construction industry entrants use the same approach to conflict management as the industry's current members. In particular, the weak Collaborative conflict management styles of the CWU CM students will not help develop collaborative environments and will likely perpetuate the cause of failures occasionally found on IPD projects. Therefore, implementing andragogical methods that teach the relevance and necessity of collaboration to these CWU CM students may alter their own conflict management styles to be more cooperative and prepare for an evolving industry.

The collaborative trend in the construction industry, over the last 40 years, has grown and will continue to grow in the foreseeable future as construction professionals seek more efficient and effective methods to create the built environment. A collaborative culture is a primary tenant of IPD and though being collaborative sounds good in theory, it takes great effort to attain a collaborative mindset. Complicating the situation, the research determined that the average CM student at CWU is far less collaborative than the general population. Therefore, developing collaborative conflict management styles in the CWU CM students is a critical component of their success.

Employing andragogical teaching methods aids in the required cognitive processes that alters one's conflict management style. This study did not identify a distinct time or date in which students transitioned toward a more collaborative style, but it did determine that as a whole, the group moved toward a more collaborative style while enrolled in the CM program at CWU. Through andragogical learning experiences, the students were becoming more collaborative. Although it is not advisable that the students abandon their other learned conflict management styles as each style has their distinct benefits, it is important to note that their apparent short comings in collaborative conflict management is an impediment to their continued success.

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