



Active Learning Games; Challenging Players' Mindsets for Integrated Project Delivery

Mr. David Wesley Martin, Central Washington University

Certified Professional Constructor with twelve years professional experience in civil and construction project management encompassing over \$100,000,000 worth of vertical and horizontal construction. An additional ten years involved in college level construction management instruction and administration including contract and project management techniques, estimating, disputes resolution practices, planning and scheduling, safety engineering, engineering practices, and quality control. Quality oriented with a strong sense of integrity

Dr. Philip Warren Plugge, Central Washington University

Dr. Plugge is an assistant professor at Central Washington University in Ellensburg, Washington teaching heavy civil construction management. Professor Plugge has earned a Ph.D. in Education and Human Resource Studies with a focus in Civil Construction Management (2007), a Master of Science in Manufacturing Technology and Construction Management (2003) and a Bachelor of Science in Construction Management (1994) from Colorado State University in Fort Collins, Colorado. He has held positions with major construction companies such as PCL Civil Construction, Granite Construction, and Rocky Mountain Prestress as a project engineer, quality controller and production controller. His research focuses on evidence-based project delivery, model implementation in engineering and construction management education, risk analysis in construction, and undergraduate field training in construction management. He also has contributed and reviewed articles in the International Journal of Construction Education and Research.

Active Learning Games: Challenging players' mindsets for Integrated Project Delivery

David W. Martin, CPC and P. Warren Plugge, Ph.D.
Central Washington University
Ellensburg, WA

Integrated Project Delivery (IPD) is fast becoming one of the new buzz words in construction thought and practice. Although IPD has its successes and continues to grow, in both academia and the industry, IPD failures do exist. Much of the research surrounding IPD focuses on the integration of technology to streamline the construction management process however, little attention is given to the change in relationships between the project players and how these individuals must operate within this changed environment. One of the most common reasons cited for IPD failures is that the construction managers selected for these projects had difficulty adjusting their mindsets to operate within a collaborative environment despite being successful on other traditional projects. IPD is a collaborative approach to project delivery that requires a change from the traditional non-cooperative mindset that is pervasive throughout the construction industry. For decades, project team players (i.e. owners, contractors, subcontractors, designers, and other project participants) often do not cooperate with each other ingraining a non-cooperative spirit within construction managers. This spirit is not easily changed just because a contract encourages collaboration. Therefore, students in an undergraduate construction management program at Central Washington University learn about IPD through classroom lectures and active learning exercises that challenge their competitive propensities. Initial tests through the Thomas-Kilmann Conflict Mode Instrument (TKI), that measures conflict styles, indicate that typical construction management student personalities tend to be non-cooperative. This paper presents two classroom games (Prisoner's Dilemma and The \$20 Game) that students played to learn some basic IPD fundamentals and to consider the collaboration verses competition dichotomy within an IPD environment. Learning outcome assessments via standard classroom testing mechanisms were performed and the changes of competitive verses collaborative propensities via student surveys are measured and their respective results are presented.

Introduction

Market forces within the construction industry are demanding more collaborative environments. Construction Management at Risk, Design – Build, and more recently Lean Construction and Integrated Project Delivery (IPD) now account for the majority of all construction projects. In particular, IPD by its very definition requires a significant level of collaboration to succeed. “IPD is a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste and maximize efficiency through all phases of design, fabrication and construction. IPD principles can be applied to a variety of

contractual arrangements and IPD teams can include members well beyond the basic triad of owner, architect, and contractor. In all cases, integrated projects are uniquely distinguished by highly effective *collaboration* [emphasis mine] among the owner, the prime designer, and the prime constructor, commencing at early design and continuing through to project handover”¹. However, these increasingly collaborative project delivery systems do not ensure collaboration. Lean Construction has had a positive impact on the construction industry but, success does not always find its way into every project. In fact, several opponents dubbed Lean Construction as “Mean Construction” as evidenced by the November 21, 2007 cover story of Engineering News Record entitled “Lean Without Mean”¹³. The reasons for failure are varied and vast but, one of the most common reasons cited is that the project managers or superintendents selected for these projects had difficulty adjusting their mindsets to operate within a collaborative environment. Many had been very successful on more traditional contracts but, the habits ingrained into them resulted in non-cooperative attitudes. As these convictions reveal themselves, expectations are dashed and distrust ensues. Consequently, distrust among project participants leads to poor communication, conflict, and reduced performance. Many in the construction industry understand this dilemma and attribute the problem to unwillingness on the part of the project participants to behave in a collaborative manner¹⁶.

The purpose of this paper is to provide follow-up to a previous conference paper that was used to provide construction educators insight into active learning games that illustrate IPD collaboration principles¹². The conclusions presented in the aforementioned conference paper indicated that students generally looked favorably upon the use of the games (Prisoner’s Dilemma and \$20 Negotiation Game) to demonstrate the importance of being collaborative which is of critical importance in IPD projects¹. In each case the students felt the games enhanced their understanding of project management as a future construction manager. One student commented in writing that “This game (Prisoner’s Dilemma) has shown me... [that] it will probably have to be me to put my foot forward to begin developing trust between the companies. I hope to be a part of a company who trusts...”

Despite the students’ positive responses to the games, no empirical measure was employed, in the previous conference paper, to gauge the students’ conflict styles. To alleviate this issue, a baseline mechanism known as the Thomas-Kilmann Conflict Mode Instrument⁵ (TKI), was employed to determine the students’ conflict styles prior to the activity based games to determine if these future construction managers’ attitudes were consistent with many already in the industry. It could be argued that adjusting these mindsets could solve the “Mean” problem. However, these personality traits are not easily altered. These traits are often embedded into the individual’s psyche. In order to bring about change in the way an individual thinks, an epiphany or an awakening needs to take place. In an effort to bring this about, two active learning exercises were employed at Central Washington University’s Construction Management Program encouraging construction management students to reconsider the values associated with collaboration.

Active Learning

Active learning has been performed in several different forms to expose students to various subjects in construction. The idea of active learning was first established through the works of

Kurt Lewin, John Dewey and Jean Piaget, where they 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”⁹. Kolb⁸ 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.” He also suggests, understanding of strengths and weaknesses helps in the application of what is being learned and removes the process of learning as a special activity in the classroom and becomes an “integral and explicit part of work itself”⁹.

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 a classroom setting. Gier and Hurd⁴ investigated different approaches to active student 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, Simms¹⁷, stated that an experiential learning approach or active learning provides a solution to three challenges in diversity education, “providing a holistic education, addressing the dilemma of individualism and equality in the classroom and providing a safe climate for learning. The dual knowledge theory of experiential learning theory depicts learning as a holistic and integrated process that attends to what learners think as well as what they feel, perceive, and do”.

Construction management researchers have explored the ideas of active learning in different forms including interactive games or hands-on models to demonstrate construction management concepts. It has been found that construction management students learn differently than other disciplines. Stein and Gotts¹⁸ found through a Meyers Briggs survey questionnaire of 73 undergraduate construction management students, mostly juniors and seniors that 75% 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% of the students preferred hands on or activity based learning. Researchers have also found that construction management students are kinesthetic learners, who prefer to learn by doing, as opposed to listening to a lecture^{2,3}.

Active learning models have been used to teach many concepts in construction management. Bray and Manry² 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 Plugge³ used a working model of a heat pump to demonstrate the refrigeration cycle commonly. Their statistics showed through the use of a hands-on active learning model there was some association between perceived knowledge and actual knowledge when the model was used. Furthermore, the use of the 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”². In plan reading Hubbard and Hubbard⁷ provided an example of how a steel structure could be used as a model to teach students about the various connections and steel commonly found in most structures. The problem they found was through questions in class students invariably did not know basic concepts of steel construction. What they found was through using the steel structure model was that it provided a “hands on”

experience for the students and provided a more meaningful experience when learning about steel and steel connections.

Although models are commonly used in construction management courses to demonstrate concepts within the construction curriculum, games are also an effective active learning tool to teach concepts in construction management. Gier and Hurd⁴ used games to teach concepts in team building and leadership in construction management. The purpose of their activity based learning exercise was to teach students about their own strengths, weaknesses and leadership styles. They found CM students prefer getting actively involved since they will be “expected to act, make decisions, solve problems, manage people and build projects⁴. Leathem and Tatum¹⁰ used a Jeopardy style game show as an active learning tool to teach concepts in building science, materials and methods, and mechanical, electrical and plumbing (MEP) courses. Their research showed that this type of game delivery reached the millennial type of student and created a greater interest in the courses. Lee¹¹ took a more critical look at the design issues related to games and simulation exercises in construction management. As Lee¹¹ suggests, although there are many games used as an educational tool they provide a platform for “interactive, participatory and contextually rich environments” for construction education. He also theorizes that game and simulation based learning provides “context specific-knowledge and awareness which leads to improve students’ understanding of concepts and their interrelations”.

Methodology

The TKI and the active learning games were employed in a project management course at Central Washington University. Prior to engaging in these games, researchers distributed the TKI to determine construction management students’ predominant conflict styles. Following the TKI analysis, students then engaged in two activity based games (Prisoner’s Dilemma and the \$20 Negotiation Game) in an effort to encourage them to consider alternative collaborative attitudes by which to manage construction projects from an inter-personal relationship perspective.

Thomas-Kilmann Negotiation Styles



Figure 1: Thomas-Kilmann Conflict-Handling Modes⁶

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 his own concerns, and (2) cooperativeness, the point 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 styles an individual uses when dealing with conflicts. These five conflict-handling modes are shown in Figure 1:

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 at times. So too with "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-handling mode varies with the needs of the specific conflict situation. Following is a brief description of the modes and the psychology behind each⁵.

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. A competing position is equated with standing up for one's rights and defending a position that is either believed to be correct or the individual may just want to win.

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. There is an element of self-sacrifice by obeying another person's order when one would rather not, or yielding to another's point of view.

Avoiding is unassertive and uncooperative. The individual does not immediately pursue his own concerns or those of the other person. He does not address the conflict. 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. It means digging into an issue to identify the underlying concerns of the two individuals and to find an alternative which meets both sets of concerns. Collaborating between two persons might take the form of exploring a disagreement to learn from each other's insights, concluding to resolve some condition which would otherwise have them competing for resources, or confronting and trying to find a creative solution to an interpersonal problem.

Compromising is intermediate in both assertiveness and cooperativeness. The objective is to find some expedient, mutually acceptable solution which partially satisfies both parties. It falls on a middle ground between competing and accommodating. Compromising gives up more than competing but less than accommodating. Likewise, it addresses an issue more directly than avoiding, but doesn't explore it in as much depth as collaborating. Compromising might mean splitting the difference, exchanging concessions or seeking a quick middle-ground position.

Each person has the ability to use all five conflict styles and no one can justifiably be categorized as having a single inflexible style of handling conflict. However, any individual applies some modes better than others and therefore, is inclined to rely upon those modes more habitually than others, whether because of temperament or experience in using them. The challenge for IPD participants whose predisposition is to be "competing" or "avoiding" is to learn how to acclimate to more cooperative styles because the situation of an IPD project requires it for success¹.

Prisoners Dilemma

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 1992¹⁴ 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 even if the risk is greater. Equally important is to reveal the construction students' own propensity to betray and take a non-cooperative stance against another.

To play the game, the class was divided into two groups and placed in separate rooms and completely shut off from each other. Each group was then advised that the goal of the game was to earn the most points possible for their group. There was significant effort to avoid presenting this game as a competition. For example, groups were identified as groups and the word team was never mentioned. Also, it was repeated numerous times that the goal was to earn the most points possible for their respective groups with no mention of the other group's results. Each group was then tasked to choose either the letter "X" or "Y" for the first frame. If both groups 1 & 2 chose "X", then both teams received -1 points. If both groups chose "Y", then both groups received +1 points. If group 1 chose "X" and group 2 chose "Y", then group 1 received +3 points and group 2 received -3 points and then vice versa. Neither group knew what the other group chose until they made their choice. Once the choices were made, the respective points were then allocated for that first frame. Once the first frame was over, the groups would then do the same in frame 2 and when frame 2 was complete, then again for frame 3 as well. This continued over a series of 10 frames. Groups were kept in isolation from each other except between frames 2 and 3 and between frames 5 and 6 when a representative from each group would discuss in private and work out a negotiation. Each frame acted separately from the next but the values earned or lost were cumulative. See Table 2 for the results.

\$20 Negotiation Game

The \$20 Negotiation Game is an adaptation to the \$2 Game that was first developed by Rowe¹⁵ which is a simulation game to demonstrate win/lose bargaining and negotiation and conflict management. At Central Washington University, the game was changed from negotiating \$2 to \$20 to increase the importance of the dollar amount. 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. Topics which the game demonstrates are the nature of competition and concepts in bargaining range. In playing the game students begin to understand strategies typically used in negotiation which include competition, collaboration, avoidance, compromise, accommodation, and revenge.

To play the game the students were divided into pairs. The general instruction for both players at the start is to divide the \$20 in half and this was to be a pure win-lose situation with no side deals, all or nothing. After this session the instructor facilitated a debriefing session. Without telling the students in the beginning, the game is then played two more times. In the second round students change partners with another student in the class. At this point the students are provided “Secret Instructions”. Secret instructions are meant to tilt each player toward competition, accommodation or compromise. The secret instructions will also change students attitudes on intangible and tangible items typically found in construction negotiation. In the third round the students are then told they will go back to their original partner they started the game with.

Within the next two rounds students will be given special instructions that push students to explore a particular style of behavior. These styles of behavior are grouped as a bargaining range with the effect of getting as much as you can, be constrained on competitive vs. distributive behavior with the effect of maintaining long-term relationships or tilt the negotiation toward a competitive vs. distributive behavior to expose a negotiator’s tough style or lack of trust. There are several case scenarios; examples shown below are those that were used for this research study¹⁵:

Bargaining Range: Get as much as you can

- **\$5.00** - Try to get as much of the \$2.00 as you can. Bargain as effectively as possible; make up any story you wish. It is extremely important to you that you at least get bus money to get home tonight: 50 cents. If you do not get at least 50 cents, you will be walking for more than an hour and it will be dark and cold, out where you live. Actually, get more if you can; be as effective as possible.
- **\$1.30** - You have been carefully chosen for a particular goal in this simulation. It is important that you should win at least \$1.30. Feel free to make up any story you like; get as much of the \$2.00 as you can.

Constraints on Competitive/Distributive Behavior: Effect on long term relationships

- **Public Reputation** - This is zero-sum bargaining and you should get as much of the \$2 as you can, with any story you like. However, you are a well-known public figure, with a reputation for fairness, decency and graciousness. Your reputation is extremely important to you and you should bear in mind that your colleague is likely to make public anything you say (and how you say it). So--do as well as you can, use any arguments or story you wish, but keep your reputation!
- **Hard Time** - This person you are dealing with probably will not want to tell you about it but he or she has had a terribly hard month. This past month was full of disaster: money troubles, family difficulties, and none of it your colleague's fault. Through it all, your colleague has been bearing up. Nevertheless, this is zero-sum bargaining, so get all you can. Make up whatever story you wish, and get as much of the \$2.00 as possible. (Just remember that your colleague has been having a very hard time.)

Tilting Toward Competitive/Distributive Behavior: The effect of tough style or lack of trust

- **Battle Ax** - You are a well-known and consistent battle-ax. You are known for always getting every penny out of every competitor. Please try to imagine that you will never see the other person again, but everyone else who matters to you is waiting to see if you can play this game effectively. Make up any story you want, as strong a case as you can. Get as much of the \$2.00 as you can. This is a chance to live up to your formidable reputation as a really effective competitor; go to it!
- **Say as Little as Possible** - This is zero-sum bargaining and you are to get as much of the \$2.00 as you possibly can. Please try really hard. Here is your special instruction: pick an expectation of what you will try to get and stick to it if you can, but say as little as possible. If you can, try to get away with saying essentially nothing at all, except for the amount you want. You may listen courteously as much as you want but try as hard as you reasonably cannot to talk. If you absolutely have to, make up a story to bolster your claim, but try to (if you can) not to talk at all except for stating an amount of money.

At the end of each round there is a debriefing session to discuss the concepts of negotiation. In addition to the debriefing sessions, students are then provided a questionnaire which allows the students to answer some specific questions about the game and reflect on what they have learned in the process. The central point of the \$20 game is to illustrate the basic concepts and applications of collaboration and negotiation in an activity based demonstration.

Survey Questionnaire for Project Delivery Games

Table 1

Quantitative survey questions

Question	SA	A	N	D	SD
1. This exercise added to my understanding of topic X.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. This exercise helps in my professional development as a construction manager.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. The concepts acquired in this exercise have changed how I view topic X.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. This exercise will likely cause me to be a more effective future construction manager regarding production.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I recommend that this exercise be continued for future students of this class.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Experiences in the classroom were observed and documented through a simple questionnaire provided to the students at the conclusion of the active learning exercises. Shown in Table 1 is the survey questionnaire used by the professors to gain insight to what students were learning in the exercises. As presented in Table 1, a Likert scale questionnaire ranging from 1 = strongly disagree to 5 = strongly agree was used to measure whether students felt their understanding of the topic was enhanced, identify whether the topic helped in their professional development as a construction manager, changed their views on the subject, identify whether the exercise would help the student become a more effective construction manager and make recommendations to whether the exercise should be performed in future classes.

Standard qualitative questions were also asked to assess what students learned from the games as they relate to construction project management:

6. What were the lessons that you learned from this game?
7. What implications does this game reveal about the construction industry?
8. How will these lessons affect how you will manage construction projects in the future?

Results and Discussion

In addition to class discussions, students were also assessed through the TKI questionnaire to assess their conflict styles. Students were also asked to complete the Likert scale questionnaires to identify their understanding of the topic associated with each game. The researchers at Central Washington University were interested in discovering the implications that the conflict styles would have on the IPD results. The primary question is to determine if the conflict styles would reveal how construction students would behave as project managers in the future.

Thomas-Kilmann Conflict Mode Instrument

Upon acquiring the data and developing conclusions regarding the active learning games from the 2013 project management class, researchers determined that the incorporation of the TKI would provide useful insight in interpreting future results. Therefore, the TKI was administered to twenty-nine students during the 2014 project management class. Unfortunately, students from the 2013 class were not included in this TKI study. Based on the results, as a group, "Avoiding"

was the dominant conflict style followed by “Competing.” “Collaborating” proved to be, by far, the least predominant as shown in Figure 3. Since the data gathered to determine the US general population conflict style averages (Figure 2) is not available to the authors, it is impossible to determine how much the Central Washington University CM students statistically deviate from the US general population but, by comparison, the Central Washington University construction management students appear to be significantly different in at least the “Avoiding” and “Collaborating” categories. Interestingly, these two categories are polar opposites on the conflict styles chart. Furthermore, the two categories showing the most predominant conflict styles reside on the non-cooperative side of the conflict style chart while the least dominant style among the Central Washington University CM students is considered to be the most collaborative.

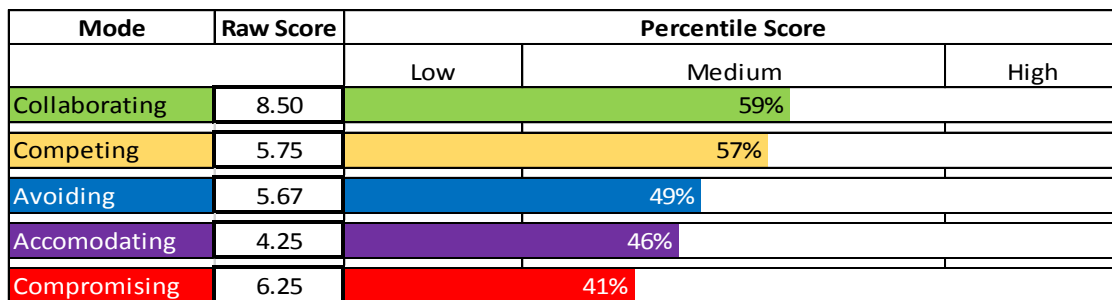


Figure 2: US General Population Average TKI Conflict Mode⁵

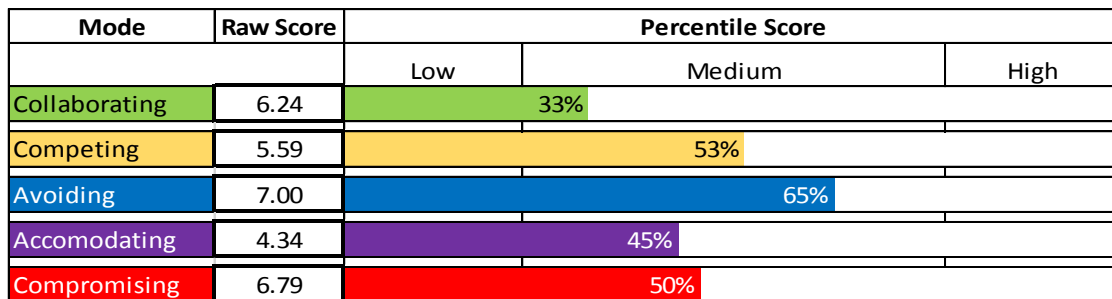


Figure 3: Central Washington University CM Students Conflict Mode

Prisoner's Dilemma

In both the 2013 and 2014 events, all four groups started off aggressively. Each group chose “X” in the first two frames. Between frames 2 and 3, each group chose a representative from their group to negotiate each group’s next move. In private, each representative agreed to choose “Y” in frame 3. However, as is evident, three out of the four groups ended up choosing “X” despite the agreement. Between frames 5 and 6, representatives again negotiated an agreement to choose “Y”. The results during this attempt appeared to show an increase in collaboration but, it was short lived. Table 2 reflects the tabulation results of the games that were played.

Trust is the key component to foster collaboration and trust either increases or decreases based upon the actions of the other party. In the case of Prisoner’s Dilemma, trust continued to deteriorate as the actions of each group increasingly bred distrust. The experiences gained from this game had a profound impact on some of the students. Several commented that competitors are not necessarily the enemy and that it is better to increase the size of the proverbial pie through collaboration than to get a bigger share of a smaller pie through competition. On one

occasion, several students indicated that the results of this experience impacted how they approached the \$20 Negotiation Game. They indicated that they approached the game from a much more collaborative stance than they otherwise would have prior to this experience. Table 3 shows the responses to the survey questionnaire.

Table 2

Prisoner's dilemma tabulation results (2013)

Frame	1	2	3	4	5	6	7	8	9	10	Total
Group1	-1	-1	-1	-1	-1	+1	+1	+3	-1	-1	-2
	X	X	X	X	X	Y	Y	X	X	X	
	X	X	X	X	X	Y	Y	Y	X	X	
Group2	-1	-1	-1	-1	-1	+1	+1	-3	-1	-1	-8

Prisoner's dilemma tabulation results (2014)

Frame	1	2	3	4	5	6	7	8	9	10	Total
Group1	-1	-1	+3	-1	-1	+3	-1	-1	-1	-1	-1
	X	X	X	X	X	X	X	X	X	X	
	X	X	Y	X	X	Y	X	X	X	X	
Group2	-1	-1	-3	-1	-1	-3	-1	-1	-1	-1	-14

Table 3

Descriptive statistics for prisoner's dilemma (2013)

Question	Minimum	Maximum	Mean	SD
This exercise added to my understanding of collaboration.	3	5	4.09	0.60
This exercise helps in my professional development as a construction manager.	3	5	3.83	0.58
The concepts acquired in this exercise have changed how I view competition and competitiveness	2	5	3.83	0.89
This exercise will likely cause me to be more collaborative as a future construction manager.	1	5	3.96	1.02
I recommend that this exercise be continued for future students of this class.	1	5	3.91	1.08

(N = 23)

Descriptive statistics for prisoner's dilemma (2014)

Question	Minimum	Maximum	Mean	SD
This exercise added to my understanding of collaboration.	3	5	4.06	0.63

This exercise helps in my professional development as a construction manager.	3	5	3.84	0.58
The concepts acquired in this exercise have changed how I view competition and competitiveness	1	5	3.19	1.01
This exercise will likely cause me to be more collaborative as a future construction manager.	2	5	3.71	0.74
I recommend that this exercise be continued for future students of this class.	2	5	3.94	0.81

(N = 30)

The results changed very little between the 2013 and 2014 events. From the responses of the self-evaluation questionnaire, students who participated in the Prisoner's Dilemma game felt the game added to their understanding of collaboration and also felt the exercise helped change how they perceived collaboration as a future construction manager.

\$20 Game

Through the experimentation of delivering the \$20 Game it was observed that students commonly found themselves in various conflict modes. It was also observed that some students really engaged into the game and others did not necessarily take the game very seriously. The students that were involved were pretty creative in how they could negotiate their point and in many cases became emotionally involved in the game. This could be observed through the intense discussions between students. In this class, many of the observations were similar to those observed by Rowe¹⁴ in that students were introduced to the ideas of reward, sanctions, force, threat of force, relationship, best alternative to a negotiated agreement, moral authority and commitment power. Students' responses to the survey instrument are shown below in Table 4.

Table 4

Descriptive statistics for \$20 game (2013)

Question	Minimum	Maximum	Mean	SD
This exercise added to my understanding of negotiation.	1	5	3.33	1.11
This exercise helps in my professional development as a construction manager.	1	5	3.13	1.18
The concepts acquired in this exercise have changed how I view negotiation.	1	5	3.04	1.13
This exercise will likely cause me to be a more effective negotiator as a future construction manager.	1	5	2.96	1.16
I recommend that this exercise be continued for future students of this class.	1	5	3.17	1.14

(N = 24)

Descriptive statistics for \$20 game (2014)

Question	Minimum	Maximum	Mean	SD
----------	---------	---------	------	----

This exercise added to my understanding of negotiation.	2	4	3.45	0.83
This exercise helps in my professional development as a construction manager.	2	4	3.52	0.74
The concepts acquired in this exercise have changed how I view negotiation.	2	5	3.28	0.84
This exercise will likely cause me to be a more effective negotiator as a future construction manager.	1	4	3.36	0.78
I recommend that this exercise be continued for future students of this class.	1	5	3.50	0.92
(N = 30)				

The results from the \$20 game changed significantly from the 2013 to the 2014 event. The authors believe that the failure to introduce the various negotiation tactics in 2013 prior to playing the games was a major factor causing the difference between the two years. Students armed with this knowledge had a deeper arsenal from which to engage in effective negotiations. Table 4 shows that students felt that the \$20 game gave them an average level of understanding of negotiation as a construction manager. Students also provided a somewhat average response to the fact that the exercise would cause them to be more effective at negotiation in the future.

Conclusion and Future Work

Based on the TKI results suggesting that the CM students at Central Washington University are less cooperative than the US general population, it was warranted to proceed with active learning exercises to encourage students to become acclimated to the use of collaborative conflict styles with special consideration for IPD projects. For construction educators, the Prisoner's Dilemma and \$20 Negotiation Game provide is a way to introduce real world decision making problems into a classroom for students to actively engage themselves in the content provided in class. These techniques provide construction students with the necessary tools as a reference they can use in the field or workplace when given challenging situations. This is important in construction especially when it comes to interacting with other constructors including architects, engineers, owners, general public, consultants and subcontractors.

Games which engage students in the active learning process are a good way to introduce and reinforce topics. The games used in the construction management project management class helped the authors to develop construction management student's knowledge of IPD skills. Future work in this area would suggest adding additional games to the construction project management courses to reinforce subjects on conflict management. In addition, this study was limited to between 23 to 24 students. To develop a statistically robust analysis, the sample size would need to increase. Ways to increase the sample size will be to continue the games in the same class over multiple years or to present the games to students at other Universities with larger class sizes. Care would have to be taken to make sure the participants have completed a certain level of coursework to inform their decisions within the games. Typically, these games at Central Washington University are performed with senior level students.

At Central Washington University there are two different discipline tracks students can follow while pursuing their Construction Management degree which include General Construction (GC) and Heavy/Civil (HC) Construction. Interesting future work within the area of IPD that would further the knowledge of this concept would be to place students within their discipline groups, GC and HC, to see if there are differences between the groups in how the students react to the games with their cohorts. Another area for consideration is to expand the TKI study to other regions of the United States and abroad to determine if the culture in any specific region alters the predominant conflict style of CM students. Finally, these types of games could also be extended outside the academic realm to other types of construction professionals.

References

1. AIA National, AIA California Council (2007). *Integrated Project Delivery: A Guide*. AIA, AIA CC.
2. Bray, H.G. & Manry D.W. (2007). Active Learning in a Reinforced Concrete Design Class. Associated Schools of Construction Annual International Conference Proceedings. *ASC Proceedings of the 43rd Annual Conference, Northern Arizona University, Flagstaff, AZ*.
3. Carns, D. & Plugge, P.W. (2010). Creating and Utilizing a “Working Model Heat Pump” to Enhance Student Learning in a Construction Management Program. *ASC Proceedings of the 46th Annual Conference, Wentworth Institute of Technology, Boston, MA*.
4. Gier, D.M. & Hurd, M.W. (2004). Increasing the Effectiveness of Active Learning Exercises in the Construction Management Classroom. *ASC Proceedings of the 40th Annual Conference, Brigham Young University, Provo, UT*.
5. Herck, N., Thompson, R., Thomas, K., Kilmann, R. (2011). *International Technical Brief for the Thomas-Kilman Conflict Mode Instrument*.
6. <http://www.psychometrics.com/en-us/articles/using-tki-assessment-more-effectively-for-specific-situations.htm>.
7. Hubbard, B.J. & Hubbard, S.M. (2009). Utilization of AISC Steel Sculpture for an Introductory Construction Plan Reading Course. *ASC Proceedings of the 45th Annual Conference, University of Florida, Gainesville, FL*.
8. Kolb, D.A. (1976). Management and the Learning Process. *California Management Review*, Vol. 18 (3) Spring 1976.
9. Kolb, D.A. (1984). *Experiential Learning: experience as the source of learning and development*. Englewood Cliffs: Prentice Hall.
10. Leathem, T. & Tatum, M. (2012). Games as an Interactive Learning Tool: A case study of a Jeopardy style game show for construction classes. *ASC Proceedings of the 48th Annual Conference Proceedings, Wentworth University, Boston, MA*.
11. Lee, N. (2010). Design Issues and Implementation Strategies for Game and Simulation-Based Learning in Construction Education. *ASC Proceedings of the 48th Annual Conference Proceedings, Wentworth University, Boston, MA*.
12. Plugge, P.W., Martin, D., Bender, W. (2014). Integrated Project Delivery Games for the Classroom. *ASC Proceedings of the 50th Annual Conference, Virginia Tech, Washington, D.C*.

13. Post, N. (2007). Sutter Health Unlocks the Door to a New Process. *Engineering News Record*. McGraw Hill Companies. New York, NY.
14. Poundstone, W. (1992). *Prisoner's Dilemma*. New York: Doubleday.
15. Rowe, M.T. (2001). Negotiation and Conflict Management. MIT Open Courseware. URL <http://ocw.mit.edu/courses/sloan-school-of-management/15-667-negotiation-and-conflict-management-spring-2001/lecture-notes/>.
16. Rowings, James E., Federle, Mark O., Birkland, Sara A. (1996). Characteristics of the Craft Workforce. *Journal of Construction Engineering and Management*, Vol 83(8), March 1996.
17. Sims, R.R. & Serbrenia, J.S. (1995). *The Importance of Learning Styles: Understanding the implications of learning, course design, and education*. Westport, CT: Greenwood Press.
18. Stein, J. & Gotts, V. (2001). Analysis of Selected Learning Preferences of Construction Management Students. *ASC Proceedings of the 37th Annual Conference, University of Denver, Denver, CO*, 41-48.