EXPLORATORY INVESTIGATION OF THE IMPACT OF PROFESSIONAL ARCHITECTURAL EDUCATION ON TENDENCIES TOWARD WORK COLLABORATION

A Thesis

by

NEAL KAMLESHBHAI GANDHI

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Chair of Committee,	Zofia K. Rybkowski
Committee Members,	José L. Fernández-Solís
	Mardelle McCuskey Shepley
Head of Department,	Joe Horlen

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ABSTRACT

The exploratory study investigates the impact of professional architectural education on tendencies toward work collaboration. First-year Architecture Students and fourth-year students from Texas A&M University were involved in this research. The Maroon-White game was selected as my research tool. The study participants also took the human metrics test of Jung/Isabel Briggs Myres Typology before the day of administering the Maroon-White game.

When the average tendencies to collaborate for the first-year Architecture Students and the final-year Architecture Students were calculated from the end results of the Maroon-White game, there appeared a mild decrease of 6.08% in the tendencies to collaborate from the first-year to the fourth-year. However, in order to achieve statistical power to validate these results further research needs to be done.

DEDICATION

I dedicate this research work to Dr. Zofia K. Rybkowski, who never failed to teach and guide me, to my loving family who always supported me in my efforts, to my friends who always inspired me to do great work, and most importantly, to Almighty God who gave me strength and good health while completing this study.

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NOMENCLATURE

E	Extraverted
I	Introverted
N	Intuitive
S	Sensing
F	Feeling
T	Thinking
J	Judging
P	Perceiving
TTC	Tendencies to Collaborate
IPD	Integrated Project Delivery
OAEC	Owners, Architects, Engineers and Contractors

TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

LIST OF TABLES

Page

1. INTRODUCTION

1.1 Background

According to the United States Census Bureau (USCB 2013), the Construction Industry in the United States accounts for an annual revenue of approximately $850 billion. The annual revenue was $857 billion in March 2013, of which $600 billion was from private sources and $257 was from public sources. Construction process relies heavily on various people from the designing stage to the completion stage. As of April 2013, the construction industry has engaged an estimated 5.8 million people (USDL 2013).

When we are dealing with an industry of large scale as construction, it is usual to incur problems. Different ways of solving these problems have been suggested and Simulation Games is one of them. Prior research has proven that simulation games are helpful to teach group work and interaction. Simulation games highlight multi-person problems with conflicting objectives (Duke and Geurts 2004). They implement various Lean principles and methodologies to help develop solutions. Peldschus (2008) believes that Simulation Games have been developed to help find solutions to conflict situations.

1.2 Problem Statement

The construction industry has long faced challenges such as time issues and rising costs (Barrie and Boyd 1992). It would be helpful to determine if it is the process or the people, who are presenting the greatest challenges. It is an assumption of this

research that if individuals working for companies are hired on the basis of merit, their knowledge and collective skills should be sufficient to address most challenges they encounter.

This research assumes that Integrated Project Delivery process requires willingness to collaborate with fellow stakeholders. Therefore this research will be investigating the impact of architectural professional education on tendencies toward work collaboration.

1.3 Goal

This research investigates whether professional architectural education influences student tendencies toward work collaboration.

1.4 Research Objective

Owners, Architects, Engineers and Contractors (OAEC) are integral part of the construction industry and it is essential for these three stakeholders to work collaboratively. The specific objectives of this research is to determine the role played by architectural education institutions to instill qualities such as trust or distrust, collaboration or independence and commitment towards long-term or short-term thinking. It is an underlying assumption of this research that values such as trust, collaboration and long-term thinking are needed to successfully deliver Integrated Project Delivery (IPD) projects. An IPD is a collaborative project delivery method that

brings together the people, systems, business entities and practices together to maximize the project output (Eckblad et al. 2007; Matthews and Howell 2005).

2. LITERATURE REVIEW

2.1 Factors that Lead Up to a Collaborative Approach

It is an assumption of this research that a number of characteristics are needed to support collaboration among individuals namely: trust, ability of each individual, benevolence and integrity.

2.1.1 Trust

One definition of trust is that it is described as the eagerness of a person to be liable to the work of others and having the faith that others would live up to their expectations. Working in groups and having interdependencies is a prominent scenario at a work place so as to get the work done (Mayer et al. 1995). An apt understanding of trust leads to the creation of cohesion and collaboration among people. This creation is because of the application of trust. Even after the growing importance of trust, many institution and workplaces have observed lack of trust among their employees (Farham 1989).

Smith (2013) stated, "As interpersonal trust increases within the industry, inter-organizational trust between participating companies, and ultimately the general public's trust in the industry will also increase" (p. 9).

2.1.2 Ability of Each Individual

Ability is the set of proficiencies and tendencies that one possesses. It further allows them to have an influence with few specific domains. The domains have to be distinct as the individual may be very eminently skilled in some area. The individuals

will be expected to perform well in whatever they endorse as their skills of expertise (Mayer et al. 1995). In a team, specific individual abilities play an important role to make the team well equipped. A good team is one that would consist of different professionals possessing different sets of skills.

2.1.3 Benevolence

It is the will to do something good for others, keeping one's own selfish motives aside. It is an essential characteristic and comes into use especially when there are teams and everyone has to perform keeping the team in mind. Rosen and Jerdee (1977) believed that the trustee would prefer organizational goals to individual goals, which is a clear indication of benevolence.

2.1.4 Integrity

Killinger (2010) stated, "Integrity is personal choice, an uncompromising and predictably consistent commitment to honor moral, ethical, spiritual and artistic values and principles" (p. 12). It is built over time. It takes into consideration factors such as the individual's personal behavior, the way of communication with his or her colleagues, having a strong moral system or not and also doing what he or she preaches (Mayer et al. 1995). All these factors are taken into consideration when someone is determined to possess integrity. McFall (1987) implied that personal integrity is defined by adhering to a set of regulations.

2.2 Current Scenario of Undergraduate College Education in the U.S.

To support the recent emergence of IPD among Owners, Architects and Contractors (OAEC) professionals this research assumes that it is important to develop an educational system that promotes work collaboration and cooperation. According to Cortese (2003) college education in the US emphasizes competing as individuals and working to excel by overshadowing others. There are some indications that university education in the U.S. tends to promote competition over collaboration in some fields. This actually creates students with a mindset that is not collaborative. Because IPD requires tendencies for OAEC stakeholders to collaborate, faculties should also change their existing professional practices and should encourage more collaborative approaches among students at institutions. Cortese (2003) argues that the universities should aim to bring transformative change, which can only happen by connecting head, heart and hand.

The first-year of university is an important year in the sense that it involves changeover in a student's life. Student's become more active as they start as freshmen and take part in the socialization process (McInnis 2001). In a longitudinal study, it was found out that critical thinking ability increased significantly from first to fourth-year.

2.3 Need for a Collaborative Teamwork and Trustworthiness

To become successful at a job it is necessary to coordinate with others (Johnson and Johnson 2004). According to Vygotsky (1978), exchange of information with classmates is a good way to enhance one's psychological growth and also increase the level of intelligence. Collaboration can be the key to overcome work related obstacles.

Collaborative learning can inherit the quality of working in groups towards solving one common goal among all. The faint difference between collaborative and cooperative learning is "the emphasis on student interactions rather than on learning as an individual or private activity" (Prince 2004, p. 1). In collaborative learning, everyone tends to engage their own minds at problem solving.

Inspiration to actively participate, learn constructively, analyze information and engage in goal-based learning is common to conventional collaborative environment (Chou and Chen 2008; Graham and Misanchuk 2004).

Basic essential characteristics of a group setting should include the following: cooperation, conversation, teamwork, confidence and coherence (Greenlee and Karanxha 2010). Constructive conversation tends to bond all the team members together. Sarker et al. (2011) conclude that better interactions leads to better achievement.

When group members are familiar with one another, it can lead to an improved team environment, which shows tendencies to collaborate (Janssen et al. 2009; Stark and Bierly 2009). Closeness among the team members helps to communicate strengths and weaknesses of each member so the team can optimize its output.

Groups utilize methods such as team-based, problem-based, collaborative, cooperative, inter-professional and active learning. The above mentioned terms have their own importance and they are not synonyms (Begley 2009; Gallagher 2009; Meseke et al. 2009; Sweet and Svinicki 2007).

In the work of Way et al. (2000) collaboration is defined as "a way of working, organizing, and operating within a practice group or network" (p. 3).

2.4 Problem Based Learning (PBL)

Problem-based learning (PBL) is a way, which requires students to be collaborative with their colleagues to be successful. This approach will be used in this research to highlight the importance of collaboration. Results from this research will help demonstrate the impact of professional architectural education on attitudes toward work collaboration.

The components of PBL, proposed by Savery (2006) are adapted to include lean tools as follows:

1. Students are held liable for their own learning.
2. The problems used in Problem-Based Learning should be open for analysis.
3. Knowledge from various subjects can be applied to solve the problem.
4. Collaboration is must.
5. Information should be gathered from all the group members before arriving at a solution.
6. The learners should also analyze the problem using tools such as a plus/delta chart, pros/cons chart, *ishikawa* fish bone diagram etc.
7. Things that are learned from the problem should be noted.
8. Class evaluation should be done at the end of the problem.
9. An assessment should be done to measure the amount of knowledge gained by the student at the end of process.

2.5 Simulation Games Concerning the Prisoner's Dilemma

It has been frequently observed that two rational players playing the prisoner's dilemma game would never collaborate and cooperate even if the game was played a number of times. Scheff's (1967) theory clearly states, "If motivation to coordinate is high and constant, then the degree of coordination is a function of consensus and communication" (p. 234). Or, to be more specific, "Coordination depends upon consensus, which, in turn, may depend upon communication" (p. 226).

Each player must not only plan to cooperate but should also expect that the other players would cooperate and vice-versa. When an individual players start believing that other players would understand and act in the same way as him or her, then is only when consensus exists and collaboration results (Boyle and Bonacich 1970).

It has been observed that players tend to look out for immediate self-benefit rather than long-term team interest. As the game progresses, students often treat the game as a competition and they want to win. "Trust refers to expectations of benevolence; whereas suspicion refers to expectations of malevolence" (Solomon 1960, p. 223).

It happens that the Prisoner's Dilemma situation is witnessed often when Lean simulation games are played, such as the one that will be performed during this research.

2.6 Freshmen (First-year) and Seniors (Fourth-year) Architecture Students

Wilson's (1996) study in the UK reported that there are some striking changes visible in architectural students during their course of education. During the course of

architectural education the students develop increasingly conceptual and distinguishable concepts, which keep intensifying over the period of their study. There are mainly two different systems of construct under the study: conceptualization and evaluation. The first system is mainly about understanding architecture that is definitive, objective and non-evaluative while the second is about throwing light on abstract evaluative judgment. Both of these two different systems are inherited during the course of professional education.

Even the understanding of different architectural styles becomes more intense while progressing toward the end of the education period (Erdoğan et al. 2010).

2.7 Learning Collaboration

Collaboration can be learned in classrooms if the right framework is adopted (Astin 1991). However students need institutional guidance that promotes collaborative learning. The faculties can assist the students by making them work in teams in order to achieve a common goal. This will also develop their teamwork skills.

It has also been noted that loosely constructed group learning without facilitation can lead to negative results compared to an individualistic approach such as lesser affirmative bonds among students and also demotion of students' healthy mental adjustment to college (Johnson et al. 1991). While working in groups, the students should develop new insights related to the study. When the class is separated to form small groups, a new social clan is created that works towards attaining the goal. During the process, various ideas are exchanged and eventually all the group members settle for

one outcome for the problem of inquiry collaboratively based on those exchanges (Slavin 1995a, 1995b).

Benefits from collaboration are attained when each team member realizes that his or her success relies on the group's success and when he or she starts working wholeheartedly for the team's cause (Cooper et al. 1994). It has also been observed in Colbeck et al.'s (2000) study that students with previous exposure of working in groups were better at working collaboratively on an ongoing project.

In case of collaborative learning, the professor has to take the initiative to create a situation where all the team members get together and try to work out the problem as a group, and not individually (Levine et al. 1993).

Cooper (1999) rightly stated, "Collaborative activities in the classroom are some of the most effective means for increased conceptual gains and enjoyment of the learning task" (p. 169).

3. METHODOLOGY

3.1 Research Methods

3.1.1 Maroon-White Game

This research used the Maroon-White game (Smith and Rybkowski 2013), which was adopted from the Red-Black game found on the College of St. Benedict website (CSB-SJU 2012). It uses the concept of point accumulation to inspire team performance. This game tries to highlight the fact that greater collaborative gains can be achieved in the short run and greater individual gains can also be achieved in the long run if a collaborative approach is chosen over an individualistic approach.

The game was played as follows:

1. The following score chart (Table 3.1) was written on a chalkboard or dry-erase board so that everyone could see (M = Maroon, W = White):

Table 3.1 Maroon-White Scoring Chart

Team Choice	**Point Distribution**
M-M-M	50-50-50
W-M-M	100-0-0
W-W-W (All other combinations)	0-0-0

2. The class was divided into three teams.

3. The goal of the game was to score as many points as possible.
4. For each round, each team had to pick a color, either maroon or white, and then had to report their selection to the facilitator when asked.
5. Scores were then distributed to each team based on the point distribution included above.
6. Scores for all the rounds were noted on the white board/flip chart.
7. The TTC metric for each studio was calculated using the following equation:

$$\text{TTC} = \frac{\text{Number of Maroon Responses}}{\text{Total Number of Responses}} * 100$$

3.1.2 Human Metric Test

It was helpful to understand whether collaborative tendencies emerge more from education training or from self-selection bias of individuals attracted to the study of architecture. Students were asked to take the human metrics test of Jung/Isabel Briggs Myers Typology* before they are requested to play the Maroon-White (Smith and Rybkowski 2013) game as it helps to determine the personality make up of each member of the class.

* According to HRP (2014), "Humanmetrics Jung Typology Test™ (JTT™) and Jung Typology Profiler for Workplace™ (JTPW™) instrument determine the expressiveness of each of the four personality type dimensions (Extraversion vs. Introversion, Sensing vs. Intuition, Thinking vs. Feeling, and Judging vs. Perceiving".

There are 16 possible personality type combinations:

- E (Extraverted) vs. I (Introverted)
- N (Intuitive) vs. S (Sensing)
- F (Feeling) vs. Thinking (Thinking)
- J (Judging) vs. P (Perceiving)

3.2 Data Collection

I carried out my research on first-year Architecture Students and fourth-year Architecture Students at Texas A&M University.

The Maroon-White game (Smith and Rybkowski 2013) was played with four different studios of the first-year Architecture Students and three different studios of the final-year Architecture Students. Each studio had approximately 18 students. The final results of every game were collected.

To prevent the leakage of the data among students who had played the game and students who had yet to play the game, all the students were verbally requested to not share their experience of the game with others and they all agreed unanimously.

3.3 Assumption

It was an assumption that all the first-year and fourth-year students were equipped with enough information to effectively participate in the survey.

3.4 Limitations

A primary delimitation and limitation was that only architectural students from Texas A&M University were tested.

Also there was a danger that students from one section might share their experience playing the game with students from other sections who had not yet played. This would have invalidated all results. To limit this I asked students to not share their experience with other students, both before the game began and after play.

4. RESULTS

Tables 4.1, 4.3, 4.5 and 4.7 were constructed from results of the simulation game administered to first-year Architecture Students. Tables 4.9, 4.11 and 4.13 were constructed from the results of the game administered to final year Architecture Students. Tables 4.2, 4.6, 4.8, 4.10, 4.12 and 4.14 were tabulated from the results of the human metrics test.

Table 4.1 Result – First-year Architecture Studio 1

	Team 1		Team 2		Team 3		Total
	Color	Points	Color	Points	Color	Points	Team
Round 1	Maroon	0	White	100	Maroon	0	100
Round 2	White	0	White	0	White	0	0
Round 3	White	0	White	0	White	0	0
Round 4	White	0	White	0	White	0	0
Round 5	White	0	White	0	White	0	0
Round 6	Maroon	0	Maroon	0	White	100	100
Round 7	White	0	White	0	Maroon	0	0
Total Individual Points		0		100		100	200

TTC = (5/21)*100 = 23.80%

Table 4.2 Personality Type Distribution For the Teams – Studio 1 (First-year)

Team 1	Team 2	Team 3
INTP	ESFJ	ISTJ
INTJ	ISFJ	ENTJ
ISFJ	ESTJ	ESFJ
ENFP	ESTJ	

Table 4.3 Result – First-year Architecture Studio 2

	Team 1		Team 2		Team 3		Total Team
	Color	Points	Color	Points	Color	Points	
Round 1	Maroon	0	White	0	White	0	0
Round 2	Maroon	0	White	0	White	0	0
Round 3	White	0	Maroon	0	White	0	0
Round 4	Maroon	0	White	0	White	0	0
Round 5	Maroon	50	Maroon	50	Maroon	50	150
Round 6	Maroon	0	White	100	Maroon	0	100
Round 7	Maroon	0	White	100	Maroon	0	100
Total Individual Points		50		250		50	350

TTC = (11/21)*100 = 52.38%

Table 4.4 Personality Type Distribution For the Teams – Studio 2 (First-year)

Team 1	Team 2	Team 3
←This group did not complete Human Metrics Test→		

Table 4.5 Result – First-year Architecture Studio 3

	Team 1		Team 2		Team 3		Total
	Color	Points	Color	Points	Color	Points	Team
Round 1	Maroon	50	Maroon	50	Maroon	50	150
Round 2	Maroon	0	White	100	Maroon	0	100
Round 3	Maroon	0	White	100	Maroon	0	100
Round 4	Maroon	0	Maroon	0	White	100	100
Round 5	White	0	Maroon	0	White	0	0
Round 6	Maroon	0	White	100	Maroon	0	100
Round 7	White	100	Maroon	0	Maroon	0	100
Total Individual Points		150		350		150	650

TTC = (14/21)*100 = 66.67%

Table 4.6 Personality Type Distribution For the Teams – Studio 3 (First-year)

Team 1	Team 2	Team 3
ENTJ	ISTJ	ENFJ
ENTJ	INTJ	INTJ
INTJ	INTJ	ENFJ
ENFJ	ISTJ	
	ISTJ	
	ESTJ	
	INTJ	

Table 4.7 Result – First-year Architecture Studio 4

	Team 1		Team 2		Team 3		Total Team
	Color	Points	Color	Points	Color	Points	
Round 1	White	0	White	0	White	0	0
Round 2	White	0	White	0	White	0	0
Round 3	White	0	White	0	Maroon	0	0
Round 4	White	0	White	0	Maroon	0	0
Round 5	Maroon	0	White	100	Maroon	0	100
Round 6	Maroon	0	White	100	Maroon	0	100
Round 7	Maroon	0	Maroon	0	White	100	100
Total Individual Points		0		200		100	300

TTC = (8/21)*100 = 38.09%

Table 4.8 Personality Type Distribution For the Teams – Studio 4 (First-year)

Team 1	Team 2	Team 3
ENFJ	INFP	ISTJ
ESFJ	ENFJ	ESFP
ENFP		

Table 4.9 Result – Fourth-year Architecture Studio 1

	Team 1		Team 2		Team 3		Total
	Color	Points	Color	Points	Color	Points	Team
Round 1	White	0	White	0	Maroon	0	0
Round 2	White	0	White	0	White	0	0
Round 3	Maroon	0	White	0	White	0	0
Round 4	Maroon	0	White	0	White	0	0
Round 5	Maroon	50	Maroon	50	Maroon	50	150
Round 6	Maroon	0	White	0	White	0	0
Round 7	White	0	White	0	Maroon	0	0
Total Individual Points		50		50		50	150

TTC = (8/21)*100 = 38.09%

Table 4.10 Personality Type Distribution For the Teams – Studio 1 (Fourth-year)

Team 1	Team 2	Team 3
INTJ	INFJ	ENTJ
ENFJ	INFJ	ISTJ
INTJ	INFJ	
	INTJ	

Table 4.11 Result – Fourth-year Architecture Studio 2

	Team 1		Team 2		Team 3		Total Team
	Color	Points	Color	Points	Color	Points	
Round 1	White	0	White	0	White	0	0
Round 2	White	100	Maroon	0	Maroon	0	100
Round 3	White	0	White	0	White	0	0
Round 4	Maroon	0	Maroon	0	White	100	100
Round 5	Maroon	0	White	100	Maroon	0	100
Round 6	Maroon	50	Maroon	50	Maroon	50	150
Round 7	Maroon	50	Maroon	50	Maroon	50	150
Total Individual Points		200		200		200	600

TTC = (12/21)*100 = 57.14%

Table 4.12 Personality Type Distribution For the Teams – Studio 2 (Fourth-year)

Team 1	Team 2	Team 3
ENFJ	INFJ	ENFJ
ESFJ	INFJ	ESFJ
ESFP	INTJ	ESTJ
ISFJ	ESFJ	ESTJ
ENFP	ENFJ	INFJ
ENFJ		INTJ
ISTJ		

Table 4.13 Result – Fourth-year Architecture Studio 3

	Team 1		Team 2		Team 3		Total
	Color	Points	Color	Points	Color	Points	Team
Round 1	White	0	White	0	White	0	0
Round 2	White	0	White	0	White	0	0
Round 3	White	0	White	0	White	0	0
Round 4	White	0	White	0	White	0	0
Round 5	Maroon	0	White	100	Maroon	0	100
Round 6	White	100	Maroon	0	Maroon	0	100
Total Individual Points		100		100		0	200

TTC = (4/18)*100 = 22.22%

Table 4.14 Personality Type Distribution For the Teams – Studio 3 (Fourth-year)

Team 1	Team 2	Team 3
ENTJ	INTJ	ENFJ
ISFP	INFJ	ENFJ
ENFP	INTJ	INFJ
ISFJ	ESFJ	INFJ
ENFJ	ISTJ	INTJ

5. DISCUSSION

This is an exploratory study. The data for this study were gathered by conducting the Maroon-White game (Smith and Rybkowski 2013) with four first-year studio classes and three final-year studio classes at the Department of Architecture, Texas A&M University.

The process that was used to analyze the data obtained from the game drew inferences from the end results by observing trends and group behaviors.

Following are the observations of this study:

5.1 First-year Architecture Students – Studio 1

Collaborative tendencies of this studio were the lowest of the four first-year studios and were barely observed among the students of this studio. A total of 7 rounds were conducted and only 5 responses out of a total of 21 were Maroon. In the first round we noticed that the Team 1 and Team 3 tried to implement the collaborative approach by choosing Maroon but Team 2 picked White, which earned them 100 points.

In their second round Team 2 won 100 points, Team 1 and Team 3 stopped collaborating, and they started acting individualistically. Due to this, none of the teams collaborated in the following 4 rounds. However, in the 6^{th} round, Team 1 and Team 2 implemented the Collaborative Approach, while Team 3 chose to stay with their individualistic approach by selecting White and they ended up earning 100 points.

The TTC for this studio was 23.80%.

5.2 First-year Architecture Students – Studio 2

There were glimpses of collaborative tendencies in this studio. They chose Maroon 11 out of 21 times. Team 1 in this studio was the very first to realize about the concept of collaboration and hence they chose Maroon as their choice for all rounds except the 3rd round irrespective to what Team 2 and Team 3 chose. They kept on hoping that the other teams would realize and also start choosing Maroon as their choice, but that never happened. Based on my observations, they also expressed their frustration at times because of the other team's inflexibility and rigidness to alter their approach. After the 4th round, each team was told to select one representative from their team and that person was allowed to talk with the representatives from the other two teams, so that they all could work out a common strategy to get as many points as possible. The result of the discussion reflected in the 5th round as all the teams chose Maroon in that round. The collaborative approach did not prevail for long as in the very next round Team 2 again went for white which eaerned them 100 points. The same situation was repeated in the 7th round.

The TTC of this studio was 52.38%.

5.3 First-year Architecture Students – Studio 3

The tendencies to collaborate of this studio were the most of the four first-year studios. They selected Maroon 14 times out of their 21 responses. Unlike the other first-year studio's, they had the best start as all the teams selected Maroon as their choice in the first round. But Team 2 selected White in the second round, which earned them 100

points. The other two teams still chose to stick to their collaborative mindset in the 3rd round, hoping that Team 2 would collaborate but it still did not change their approach. They, again, went for White and got 100 points. In most of the remaining rounds, 2 out of 3 teams chose Maroon but they never did collaborate. After the completion of 7 rounds, it was found out that most of the students had figured out the concept of the game.

The TTC of this studio was 66.67%.

5.4 First-year Architecture Students – Studio 4

Studio 4's performance was similar to the first studio. They selected Maroon 8 out of 21 times. There was a point in the game where none of the teams considered collaborating. Only in the 5th and the 6th round, Team 1 and Team 3 chose Maroon just out of curiosity to check whether the outcome would change or not. Nevertheless, members of Team 2 never changed their color choice. They were satisfied with their approach as it earned them 100 points in the 5th and 6th round each. They were likely under the impression that their approach was really smart, and they already started celebrating when the game neared the end.

The TTC of studio 1 was 38.09%.

5.5 Fourth-year Architecture Students – Studio 1

It was interesting to find out that the TTC did not change much even after 3 years of professional education. They selected Maroon 8 times out of their 21 responses. In

this studio also most of the students approached the game with an individualistic approach except the students in the Team 1. From the 3rd round till the 6th round, Team 1 kept on choosing Maroon, and they were satisfied, finally, in the 6th round when the other two teams understood their indication to choose Maroon. But the desire to win the game likely corrupted the student's mindset towards collaboration again in the final round as Team 1 and Team 2 chose White.

The TTC of this studio was 38.09%.

5.6 Fourth-year Architecture Students – Studio 2

The results improved in the second studio compared to the first studio of final-year Architecture Students. This studio was the only in the fourth-year batch who actually understood the idea behind the game in the last two rounds. They selected Maroon 12 times out of their 21 responses but the good thing was that after realizing the idea behind the game, they chose to stick with it, which was not observed in any other studios.

The TTC of this studio was 57.14%.

5.7 Fourth-year Architecture Students – Studio 3

The tendencies to collaborate were noticed to be the least in this studio when compared to other studios of the fourth-year batch of Architecture Students. They selected Maroon 4 times out of their 18 responses. All the teams kept on choosing White as their choice for the first 4 rounds. Interestingly in the fourth round when one young

woman from the Team 1 shared her idea to choose Maroon, all of her teammates mocked her and thought of her as a coward. They thought that she was afraid to take the risk required to win the game. The rest of her team thought that White was the only way to get more points in this game. In the 5th round Team 1 thought of giving the young woman's idea a try and they chose Maroon. Team 3 also chose Maroon in the 5th round out of anxiousness since they just wanted to give the other color a try but to their dismay Team 2 chose White and won 100 points. This just made Team 1 furious again and curses were also exchanged. Eventually they reverted back to their original approach of choosing White all the time. In fact they earned 100 points in the final round and this just made them believe that selecting White was the only way to earn as many points as possible.

The TTC of this studio was 22.22%.

It can be seen in Figure 5.1, the average TTC of the first-year students was 45.23% and in Figure 5.2, the average TTC of the final-year students was 39.15%. Hence, Figure 5.3 shows the mild decrease of 6.08% observed in the average TTC of first-year and final-year Architecture Students.

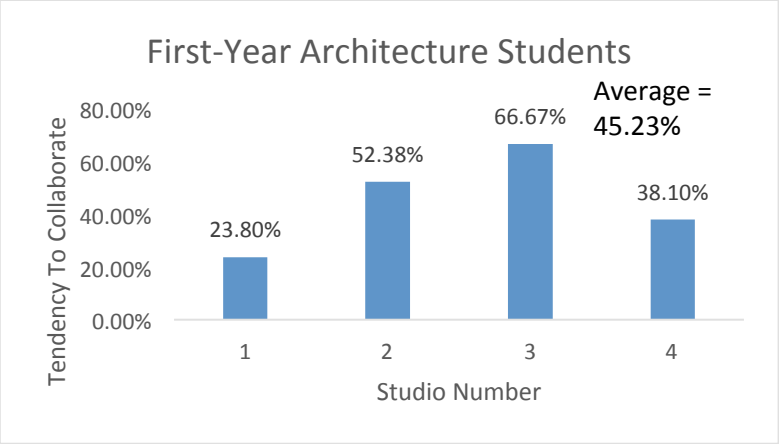

Figure 5.1 Bar-Chart of the First-year Architecture Students TTC

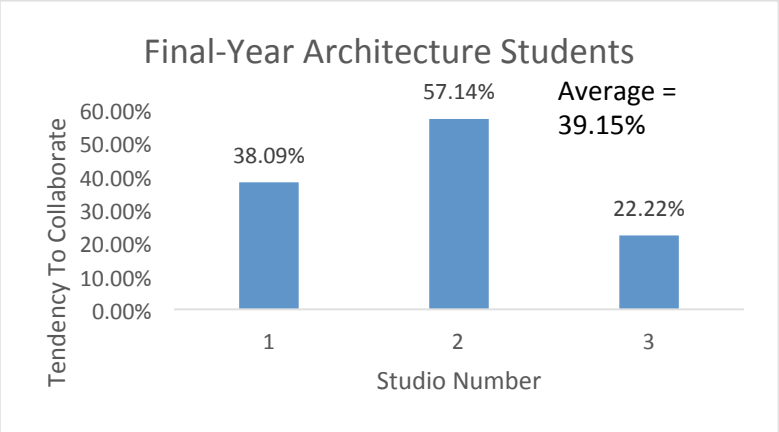

Figure 5.2 Bar-Chart of the Final-year Architecture Students TTC

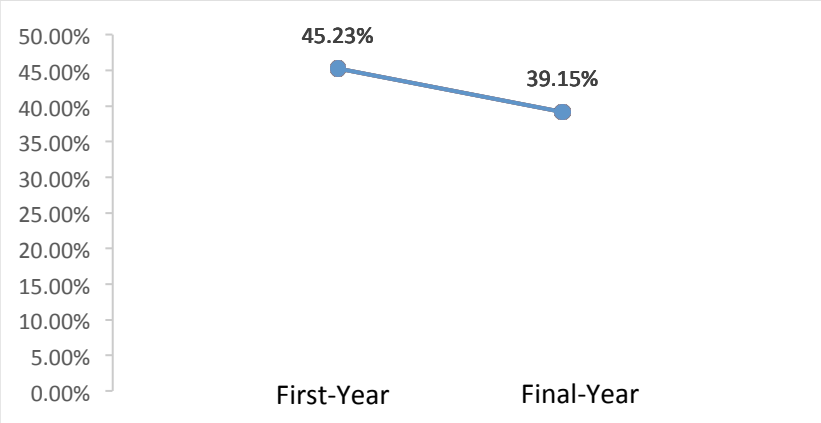

Figure 5.3 Plot of the Average TTC of First-year and Final-year Architecture Students

Table 5.1 Number of Personality Types Observed in Architecture

Personality Type	Number of Times
INTP	1
INTJ	15
ISFJ	5
ENFP	4
ESFJ	7
ESTJ	5
ISTJ	7
ENTJ	5
ENFJ	13
INFP	1
ESFP	2
INFJ	8
ISFP	1

Percentage of J's = (65/74)*100 = 87.83 ≈ 88%

It was observed from the results of the human metric test that there were 65 participants who had "judging" personalities out of the 74 participants who took the human metric test. It is interesting as the percentage of J's is 88%, although the significance is unknown.

6. OPPORTUNITIES FOR FUTURE RESEARCH

The following variables could be considered while researching the same topic in future:

1. Whether gender difference affects the tendencies to collaborate
2. Whether ethnicity affects the tendencies to collaborate
3. Whether age impacts the tendencies to collaborate

7. CONCLUSION

The conclusion of this exploratory study is that there appeared a mild decrease of 6.08% in tendencies to collaborate when comparing the average TTC of the first-year Architecture Students with that of final-year Architecture Students. The average TTC of the first-year students was 45.23% and the average TTC of the final-year students was 39.15%.

Some glimpses of excessive individualistic approach were observed among the final-year architecture teams. However overall differences were not highly significant. To achieve statistical power to validate these results, further research needs to be done.

Although there did not appear to be any correlation between the TTC and human metrics categories, it was interesting to observe in table 5.1 that 88% of architectural students tested were defined to have “judging” (versus “perceiving”) personality types.

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APPENDIX A

E-mail to Professors

Respected Professor,

I am a second year graduate student from the Department of Construction Science, Texas A&M University. Presently, I am doing a research on the topic "EXPLORATORY INVESTIGATION OF THE IMPACT OF PROFESSIONAL ARCHITECTURAL EDUCATION ON ATTITUDES TOWARD WORK COLLABORATION", which requires me to interact with Architecture Students present in your class. I am sending you this e-mail, requesting you to grant me permission to administer the research game (Maroon-White Game) during one of your classes, preferably at the earliest. It will roughly take 30 minutes to administer the game.
I will also have to request the students to take an online Human Metric Test before the day of administering the game and also have to request them to bring their results to the class during the day of administering the game. I kindly request you to forward my recruitment e-mail to all the students of your class.

I will highly appreciate if you agree to give your precious class time to me, as it will help to make my research study stronger. Awaiting your reply.

Thanks and regards,

Neal Gandhi

Graduate Student

Department of Construction Science

Texas A&M University

APPENDIX B

Recruitment E-mail

Hello,

I am a second year graduate student from the Department of Construction Science, Texas A&M University. Presently, I am doing a study on the topic "EXPLORATORY INVESTIGATION OF THE IMPACT OF PROFESSIONAL ARCHITECTURAL EDUCATION ON ATTITUDES TOWARD WORK COLLABORATION". My study requires research. The purpose of this research is to understand the role played by professional architectural education on shaping up a student's mindset. This research requires me to administer a game (Maroon-White Game) with you all. I kindly request you to play the game with me. The results gathered from this game will be analyzed and used in my research. The duration to administer the entire game will be 45 minutes and the procedure of the game will be made clear in the class before the commencement of the game. All the data gathered from the game will be kept confidential and will be destroyed after the completion of my study. Only the results of the teams on the whole will be published at the end of my study and no personal information linking to you to my study will ever be published nor will the result of your Human Metric Test will be published. Your willingness to play the game will help me attain results in my Thesis.

If you agree to play the game then please take a Human Metrics Test before the day of administering the game. It will take additional 15 minutes approximately. The link for the test is: http://www.humanmetrics.com/cgi-win/JTypes2.asp Please bring the printed copy of the test result to class on the day of administering the game and hand it over to me before you play the game. In case of any queries feel free to contact me at any point of time via phone or e-mail or the IRB. The IRB could be reached via phone (1-855-795-8636) or e-mail (irb@tamu.edu).

Finally I would like to say that your participation is totally voluntary and any refusal to participate will not involve any penalty. You can always discontinue your participation at any point of time.

I appreciate your cooperation.

Thanks and regards,

Neal Gandhi

Graduate Student

Department of Construction Science

Texas A&M University

Email: neal18@neo.tamu.edu

Phone: 979-739-0631