

Team Building for Collaborative Learning Environment in Construction Education

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Abstract

A collaborative learning environment is essential for students' motivation and learning outcomes in construction engineering and management education. In a collaborative learning environment, students are better engaged in their own learning through a variety of class activities among peers and an instructor inside and outside the classroom. Therefore, class activities should be designed for students' learning improvement as well as team building amongst class participants within the course context. Good relationships among class participants and various class activities play a critical role in creating a collaborative learning environment in which students satisfy both their psychological and intellectual needs. The purpose of this paper is to show a case study of framework for a class environment through class activities and relationships among students and the instructor. This framework is based on freshmen in a university construction program. The elements of class activities are mainly designed in relation to the course materials for students' learning and improvement of relationships with peers and the instructor in the class. Having a good relationship in class plays an important role in creating a good atmosphere because a good class has to satisfy students' psychological and intellectual needs. This paper addresses various issues of the learning environment including "factors of environment", "goal and achievement", and "activities and rewards" from our literature review and then proposes a framework for team building among class participants. Also, the new roles of the instructor in this environment are discussed. This framework emphasizes the relationships amongst class participants. The outcomes of pilot implementations of this framework are useful for practitioners to manage and design class activities to improve students' learning and relationship among class participants.

Introduction

Students have different needs based on their standing at college. For example, seniors expect to graduate soon and are finally ready to start working. Freshmen and sophomores have not spent much time in college compared to juniors and seniors and may still be transitioning from high school to college. This is a major transition in their lives and it has a tremendous impact on them. Therefore it is evident that freshmen and sophomore need more attention in class. A classroom environment is a dynamic social system including teacher behavior and interaction between a teacher and students and students' themselves.¹⁶ The class environment is crucial for the students' learning outcomes. If students perceive their classroom environment positively with respect to what happened in the class such as teaching, learning, and the interactions, students are likely to learn better because it seems to have a profound impact on a range of outcomes.¹⁸ Besides achieving academic goals, the elements of a class environment are addressed as being participative.⁸ being respectful,¹¹ being safe from psychological or emotional harm,⁷ and being supportive.⁵ Many researchers define the elements of a class environment based on their needs such as types of class, years of students at school, and given circumstances. Additionally group activities in the class seem to facilitate intrinsic motivation and task involvement.² The concept

of social dynamics¹⁶ may include some of these elements proposed by other researchers. The elements of class for the field of construction have to be employed the characteristics of the industry because it is beneficial for the students who understand the characteristics of industry before stepping into the industry. Some of the characteristics of construction are 1) project oriented, 2) team oriented, and 3) people oriented. The construction industry is mostly based on each project and its team. Therefore the team work and relationships among team members/participants are important for the successful outcome. Most of work should be done by people in the field and office with some help of tools or equipment. And also construction personnel have many opportunities to meet and work with different types people in each project. The class for the freshmen year in the construction management has to be designed to meet the issues addressed above. This paper examines a case study of a framework for the freshmen construction class to meet the objectives of 1) Provide a class environment that help students settle down, 2) Build relationships with an instructor and students and students themselves, 3) Achieve individual academic goals, and 4) Experience in team work through provided class activities.

Literature Review

Having classes at a college is a major part of students' college life. Through classes, students achieve their academic goals in the field of study, have opportunities to meet peers, and build new relationships with them. All the factors such as type of school, program, and class subject matter can affect social climate directly or indirectly.¹² The classroom environment consists of three variables which are students' interpersonal relationships with peers and their instructors, goal-orientation of students' engagement in learning activities, and the general structure and the order of the classroom designed by the instructor.¹⁶ There are three domains in the classroom environment; personal development dimensions in relation to the competition, system maintenance dimensions by the rule, order, and organization, and relationship dimensions by friendly teacher, innovative, student-oriented teaching, and student affiliation.¹⁷ Some emphasis on relationship, growth, and maintenance accelerates positive social and academic outcomes, but a strong focus on any one area can have negative or unintended outcomes.¹² In a creativityoriented classroom, four important characteristics of the supportive environment are relationship between a teacher and students, assessment, openness and freedom of choice, and classroom activities.⁵ With respect to the classroom environment/domains, the common denominators among these researchers are the relationship between teacher and students, learning outcomes, and classroom activities. An ideal class environment may embrace these concepts to meet their own objectives of the class.

Students' perceptions of the classroom environment are affected by their instructors' effort to focus their attention on them personally.¹⁶ In a supportive classroom environment, students' motives to communicate with their instructors are positive but not their personal excuse-making reasons.¹³ Students' perceptions of and preference for the class environment depends on differences in students' motivational tendencies.¹⁵ The environments that students prefer resemble actual environments and environments most beneficial to achievement.³ Instructors' personalized education is positively related to the classroom environment. There would be more communications between the instructor and students and it will lead to aiding instructors in

understanding students' perception and preference for the classroom environment. There might be a gap between instructors' intention and students' perception and preference in the class environment, but it could be minimized by this effort. "Respect is a fundamental human value that forms the basis of character and personality. It can be considered a principle or standard and an appropriate way of acting" (p.293).¹¹ Without any respect to the instructor and peers, it is impossible to create a good classroom environment for learning and social. All the participants in the class have to be respectful to each other because the development of relationships is a key element for a respectful classroom.¹¹ A safe classroom is that students are able to freely express their individuality without concerning any psychological or emotional harm.⁷ Why is a safe classroom important? Students think this environment is important in both what and how much they learn and they feel more challenged in terms of personal growth and awareness in a safe classroom.⁷ A safe classroom is where students could possibly be themselves without any prejudice, and shows the positive relationship with increasing student learning or at least increasing effort and commitment.⁷ The supportive climate is related to support by both faculty and peers.⁸ It means faculty and peers have to participate in being supportive. Even though there are many opportunities in terms of class activities provided by faculty in the class, students have to perceive the existence of a supportive climate.⁸ All these elements have a positive relationship with the classroom environment and eventually learning outcomes. Some of these elements have to be employed in the class based on the class material and instructors' class objectives. Many students think that the instructors are responsible for the classroom environment, but they are not.⁷ Instructors should emphasize the importance of the classroom environment and let students know both the instructor and students are responsible for the classroom environment.

Classroom environments aid student in achieving academic goals and building their relationships with peers and instructors. To achieve academic goals, the motivation is crucial. There must be a relationship between classroom environments and students' motivation in their goals. Students' classroom perceptions and preferences are related to students' achievement goal orientations and preferences.¹⁵ "Teachers' practices and classroom norms, rules, and routines contribute to students' perceptions of goal structures" (p.368).¹⁴ The perceive classroom environment indirectly influences graded performance and intrinsic motivation because achievement goal adoption influences graded performance and intrinsic motivation but is influenced by the perceived classroom environment.⁴ Students individual dispositions and belief and the environment have impacts on students' motivation, and the classroom environments are related to students' perceptions of engaging in academic tasks and the classroom goal structure.¹ Students' goal orientations are significantly related to engagement patterns and students' goalorientation patterns across different learning activities are consistent.⁹ In addition to students' supportive relationships with their peers, student cohesiveness, investigation and task orientation are the most influential factors of student motivation and teachers' support is statistically significant on both students' learning goal orientation and task value.¹⁸ Relationships between teacher and students and peers play an important role in the classroom environment. It is because the classroom is a place where the students build their network now as students and also in the future as professionals.⁶ Like personalized education,^{19, 20} students want their teachers to have interest in them academically and more importantly personally and student-centered relationship between teacher and student depicts many effective classroom relationships, and therefore students interact more closely with the teacher.⁵ Even though students' intentions for communicating with their instructors get affected by their own personalities, students' learning

outcomes are linked to their intentions for communicating with their instructors.¹³ If the programs are based on relationship areas, then they would have more positive outcomes and so the classes should be task oriented as well as supportive.¹² It is very important for teachers to have good relationships with their students for a classroom environment and students' learning outcomes and to create a classroom learning environment. For a personalized education or care based environment, teachers' effort to interact with students in and out of the class is important. Even though students' characteristics still have impact on classroom learning environments, teachers are more responsible in creating classroom learning environments than students.¹² Personalized concern such as acknowledging students by name, compliment positive behaviors, and correcting wrong behavior for students contributes to students' sense of connection with teachers and ultimately to success.⁶

The classroom is a small society and there are many different activities going on among participants – instructors and students. As many researchers address above, the classroom environment has positive impacts on students' motivation and academic goals directly or indirectly. To create this vivid environment, good relationships between the instructor and students and students themselves are necessary even though there are difference types of classroom environment. Having a good relationship might be achieved by efforts on personalized educations, concerns, and cares to students, communications, and activities in the classroom. Although the instructor does in the classroom is more influential than that of students. Based on the discussion above, the case study of a framework for a freshmen construction management class will be addressed in the following section and the characteristics of construction industry will be additionally employed in that framework. The main focus of this case study is to build good relationships among class participants through class activities.

Class Framework

The class described in this paper was a freshmen class on the construction material. It consisted of two lecture hours and two lab hours per week. There were approximately 60 students in the class. During the lecture hours, all students took the class together but, for the lab, students were grouped into three different lab sections forming of 20 students per section. Most of class activities were based on the team consisting of three or four team members. To achieve the objectives of the paper, the class and its activities had to be interesting to students first and let them decide how to participate in those activities proactively. The course was designed to have at least one class activity per week during the semester. The instructor stressed the importance of the course and the curriculum of the construction management program as well. The students had to know the general procedure of academic affairs. Their main contacts would be the advisor and the instructor if they were in trouble with something until they got used to this new environment. In the course, the instructor had to provide the students with a good environment which made student feel comfortable and proactive in the class through class activities and finally aided them in getting used to the new environment and achieving academic goals. To build the relationship between the instructor and students, the instructor had to spend more time with students in the class and off class as well. This was how the instructor built a personal relationship with students and how this changed students and their perceptions in the class. The matrix of semester and

class activities to build a relationship between the instructor and students and a relationship between students is shown in Figure 1 below.



Figure 1: Matrix of Class Activities, Participants, and Time

The matrix shows the class activities, participants, and time frame of a semester. The overall time frame of the semester was about 17 weeks. In the column of participants, "Individual" means all the students in the class and everything is done individually and "Team" means a group or team of students in that team and the activities are based on the team. In the 8th and 12th week, there were no activities going on in the class even though the course was designed to have more than one activity per week. In the 8th week, it was a school break which meant no class and in the 12th week, it was designed to have no activity in that specific week called "activity free week." It means no individual, team work, or assignment dues in that week other than regular lecture and lab hours. There were nine in-class activities and four off-class activities. The detailed description of each class activity is followed.

In Class Activities

Class Orientation & Guest Speaker

The instructor started contacting students via email prior to the beginning of semester. The email had information about the instructor, his contact information, and the course. Before the semester began the students already knew the course, the instructor, and what to do with the course. Some of students and their parents stopped by the instructor's office. Class orientation was performed on the first day of class. The instructor let students know about the course, guidelines of the course and department. A class survey form was given to students on the same day. The survey form contains questions regarding students' name and nick name to be called, any personal information that is beneficial for students if the instructor knows, students' justification of taking this class, and their academic goals in the class. Students filled out the form and gave it back to the instructor before the individual meeting. During the class orientation, the instructor tried to

give students the overall picture of the course and other department procedure (academic requirements).

There were two presentations provided in the first three weeks. One was from the director of undergraduate program in the department and the other was from the former students who took this course before. The presentation of the director of undergraduate program is important to the students because he/she is the one the students have to look for if there are class schedule related and academic problems. The students must know at least two people. One is their academic advisor and the other is the director of undergraduate program. During the presentation, they had an idea of what the departmental expectation was and what to do and what not to do. The presentation of former students gave the current students the idea of the course at a peer level. The presentation given by the former students was about their term project. After the presentation, the students had a Q&A session with former students regarding the class. Within three weeks after the semester began, the students knew most of the course and their classmates.

Class Social & Team Formation

There were two class socials. One was to be held in the early semester and the other was to be held in the middle of semester. Most of students in the class did not know who they studied with and spent next four years together in the early semester. During the first lab hours, the students had some opportunities to get to know each other before they formed their teams for the class. The construction industry heavily depends on the team work so the instructor designs many team activities within the course. This is to provide the students with the taste of team work before they graduate. The first class social consisted of two activities based on each lab section of 20 students. One was a library tour and the other was a game. The instructor organized the library tour with help of a librarian. During the tour, the students learned how to use the library resources for their classes and personal use. After the tour, the students met in a classroom for the game called "Break the Ice." The students randomly formed a team of three or four and played the game as a team to get to know their classmates well prior to their final team formation. Even though it was not enough time, they had an idea of who they studied and worked with for the semester. It was important because they were asked to form a team by choosing their members and could not change their team members once the team was formed.

The second class social is called "Boot Camp." The first class social was based on 20 students in each lab section during the first lab hours. The boot camp was based on the whole class of 60 students, competing as a team during the lecture hour. The boot camp is a team building activity which gives students a chance to get along well with. The second class social is designed to bond their relationship with their team members. The problems given to the teams were not course related. They were from the pop culture, history, movies, sports, instructor, and music, etc. One of the purposes of this activity is to show diversity in their lives because people in the construction industry have opportunities to meet a wide range of people.

Test & Team Quiz

There were three midterms, one final, and two team quizzes in the class. Before Test 3, the instructor suggested that the team members would have five extra points in Test 3 if the team

average of Test 3 was higher than a certain grade such as 75/100. It was a team effort to improve a team performance. This is a group reward contingencies.¹⁰ Unlike other team rewards, this reward is not related to other teams but positively related to team members within the team. The purpose of this opportunity is to study together as a team and to help each other not by earning a point but by studying together. Many students studied together with their team members. The result exceeded 5% above the border line. Two teams out of 14 teams did not meet the border line as a team with clear reasons but most of students showed the team effort in Test 3. Students knew what to do and how to do with their team members. Their relationships with other team members were getting closer and closer as time went by through these kinds of activities.

Since the quiz was based on the team, the team had to solve the problems as a team. If there was more than one answer on the team, they had to discuss and come up with a final answer. This is a student engagement for the quiz. Tasks will come first on the list rather than the self if responsibility for outcomes is mutual among team members.⁹ Whether the selected answer is correct or not, the team members will learn the material through engagement in the problem.¹ To have a final answer for a question, they have to discuss and if the answer is wrong, they will not forget what they get it wrong. If the answer is right, then they will learn it from the team discussion. How to prepare the quiz depends on the team. Even if a member does not know the material, that member can learn it during the team discussion and engagement.

Term Project Presentation & Lab Competition

The term project presentation was the last team activity in the class. Each team had to make a term project presentation in front of their lab participants first during their lab hours. Each lab section chose one team as their representative. Taking a vote was a method of choosing one team over the others for the final but a team could not take a vote for itself. Since there were three lab sections, the three final chosen teams made a presentation in front of the whole class. After the three presentations, the whole class took a vote for the best presentation. The first winning team earned 3% of final course grade and the rest of final teams earned 1% of final course grade. The instructor had nothing to do with the votes. It had to be done by students. The quality of presentation was way better than before and every team really did a good job on the term project. It was evident that every team spent a decent amount of time to finish the term project and to practice the presentation. During the Q&A session after each presentation, the instructor could tell the depth of knowledge they learned through the term project. The dress code and time limit were given to the final teams prior to the presentation.

There were seven lab activities in the semester. Each team performed seven lab activities as a team. Regardless of students' relationship with team members, they had to complete the lab activities. This is designed to give students an idea of team work. The students will learn how to manage the team and resolve their issues without any outside help. Five out of seven lab activities had some team rewards. This gave students a motivation to participate in the lab activities proactively and vividly. If they do well on something, then they may earn some rewards for their hard work. For example, the students could alter the concrete mix for the concrete lab even though the basic mix ratio was given. They had to use the same given materials and equipment only. The most of team researched different mix ratios and came up with their own mixture to wish for a stronger concrete. After each lab, every team shared their mixtures and

analyzed the results of all teams' results. Students really had passion for doing the lab activities. During the lab, students had chances to get to know their team members better and learn more about the team work. Since students spent a lot of time together for the class to perform class work, most of them became friends. This is their base of social network for their career in the future.⁶

Self-Evaluation

The class survey was given to the students for setting their goals in the class and justifying why they took this class. The class survey was handed out back to students again during the final exam and every student was asked whether they achieved their goals and their justification was right or not. Many of them achieved their goals set by themselves in the class and their justification was right. This is a before-after comparison for the class goal from students' perspective. The instructor occasionally reminded students of their goals during the semester. It is a good way to compare the initial goal to the final achieved goal and it can help student evaluate themselves objectively. Many of them appreciate the way the class was organized and performed with peer students and the instructor.

Off Class Activities

Individual Meeting

All the activities in the class were to understand the course and build the relationship among students and the instructor. The individual meeting was designed to build a relationship with the instructor and students. The individual meeting helped the instructor and students get to know well individually. The meeting lasted about 30 or 40 minutes per person. The goals of meeting were 1) Make the instructor a main contact if something happens, 2) Ask students to open themselves to the instructor and so does the instructor, 3) Let the students know the key personnel they need to contact, and 4) Provide the students with the instructor's expectation from students. The instructor told the students to consider this class as a family on a trip for 17 weeks. One of the main roles of the instructor for the class with students was to be a good listener, a good friend, and/or a good brother/sister. During the meeting, the students told the instructor many personal matters such as what they were allergic to, how they wanted to be treated, any learning disabilities, and something they disliked to do in the class. The instructor considered students' personal needs when managing the class and the lab. The individual meeting was required for lots of hours but the benefits from it were tremendous to build a good relationship with students. After the meeting, the instructor and students started getting to know each other better than before.

Extra Office Hours & Test Review

A test that students are the most nervous would be the first test at a college, especially freshmen. The instructor offered extra office hours for two hours in the library at a night before each test. There are two purposes of this office hours. The first is to make students feel safe regarding the test and to answer any questions they may have when they study, and the second is to have them study in the library on purpose. 50% of students showed up in the library and studied for the first test. A number of students who showed up during the extra office hours decreased gradually up to 20% as they got used to the class, the instructor, and tests. But it was a good opportunity to talk to students and discuss problems personally.

There were three test reviews available. All the reviews were done in the office and there was no open class test review. It was optional for the students with two points adding into the test grade. In average, 25% of students signed up for the review. The main goal of test review was to check students' performance and find out something the instructor could improve the students' learning. During the review, the discussion was focused on the way the students study, any lecture feedbacks, anything personal. The discussion topics were different from each test. Topics for Test 1 review was more about the personal issues. Topics for Test 2 was about the study problem and how to improve their learning. Topics for Test 3 was about what to do in the next semester. Most of them improved their grades and kept maintaining a good grade. To make sure that a student understood the materials, the instructor could figure out students' ability of studying and referred it to help the students if necessary for the further class activities.

In-Classmate Tutoring

Although the class provided students with various class activities to help students improve their academic performance, a few students still struggled with their academic performance in the class. The instructor knew who could help and who needed some help. The instructor advertised the in-class tutor system in the class, found out the tutor and tutees, and connected them. This was proposed by the instructor and performed by students voluntarily without any personal rewards for tutors. Some of students did the tutoring for the final together and this in-class tutoring system showed the positive results in the final. This is a peer relationship improvement based on the needs of students.

Design of the Study

To measure the effectiveness of this framework, students' performance data were collected from two different semesters. The first set was from a spring semester and the second set was from a fall semester. The data were students' final course grade. Both of data sets were from the same class and the instructor taught the course for two semester in a row. The difference between two data sets is the implementation of this framework. Group #1 is without the implementation of this framework in the spring semester and Group #2 is with the implementation of this framework in the fall semester. Group #1 had 42 participants and Group #2 had 55 participants. There were initially 60 students in Group #2 but two students dropped the course due to their personal reasons and three students changed their major or school during the semester. A t-test was used to compare the means of two independent samples and to test whether the differences between the final course grades are statistically significant at the error level of 5%.

The class without this framework and with this framework was tested. Since the groups are defined by the instructional methods, the independent variable is the instructional method and the

dependent variable is students' final course grade. Means of two groups are compared using a ttest. The ratio of the variance between groups to the variance within groups was used to assess whether there are significant differences in the mean final course grades of the two groups of students. The null hypothesis (H_0) of the study is as below:

H₀: $\mu_1 = \mu_2$, which means the means of the final course grades of the two groups are statistically equal regardless of the two different types of instructional methods.

The null hypothesis will be rejected if there is a significant difference between the two means statistically at the error level of 5%. Thus the alternative hypothesis (H_1) was:

H₁: $\mu_1 \neq \mu_2$, which means there is a significant difference between the two means.

Data Analysis and Results

The mean final course grade for Group #1 and #2 is 78.55 and 82.06 respectively. The mean value of Group #2 is a little bit higher than that of Group #1. The standard deviation of Group #1 and #2 is 8.06 and 7.52 respectively. The standard deviation of Group #2 is smaller than that of Group #1. Table 1 shows the descriptive statistics of this study.

Table 1. Descriptive Statistics for Two Groups

	Group #1	Group #2
Samples	42	55
Mean	78.55	82.06
S.D.	8.06	7.52

A t-test was used to check the effectiveness of this framework. The results of the t-test are shown as below:

df	: 95
t Stat	: -2.211
P(T<=t) two-tail	: 0.029
T Critical two-tail	: 1.985

The p-value of this study is 0.029, which is smaller than the error level of 0.05. The absolute value of the test statistic is 2.211, which is greater than the corresponding critical value of 1.985. Thus the null hypothesis (H_0) was rejected in favor of the alternative hypothesis (H_1). It implies that there is a statistically significant difference between the mean final grades of the two groups. This depicts that the class with this framework makes a difference in the students' final course grade.

Discussion and Conclusion

This paper addresses a class framework based on the class activities for the freshman construction management class. With respect to the characteristics of freshman and construction industry, all the class activities were designed to provide the students with a better environment for their motivation and learning in the class through building relationships among class participants. Opportunities for communication with peers and acknowledgement of peers through class activities were given to the students. Even though it might not be as effective as planned in certain aspects, these activities at least would speed up the process of building a relationship in the short amount of time. Their relationships with peers have improved radically for the semester. The relationship between the instructor and students kept improved during the semester and still keep going. The overall output of this case study was positive in both academically and socially. A majority of students had been interested in coming to the class and the lab and proactively participating in the class activities addressed before. The average of class at the end of semester was 82/100. The self-evaluation done by students was really good about their achievement in the class. The teaching evaluation was very high with impressive comments about the course. A unique class environment was created by class participants with different activities. Even though the evaluation of these activities was not officially measured or studied, various positive feedbacks from the students showed that the framework with activities made further study worth it. The results of t-test support the positive impacts of the framework on the students' performance in the course. However, there were some downsides of this framework. Some of the students focused on the relationship more than the academic goals. Regarding the teamwork, there were some free riders among team members. This is the instructor's role to manage these types of problems within this framework.

This framework was employed to one more semester in the same class and showed the positive outputs like before. The instructor had also employed this framework to some other classes through modifying to meet the characteristics of class contents and students in the class and the feedback was as much as this case study. This study shows some good aspects of class activities and relationship among class participants. But the impacts of class activities on the relationships and academic goals are not measured even though it is employed to some other classes. The level of influence has to be assessed to make this framework effective for the instructor and students. The instructor and students built a trust for each other. The relationship with a trust is the most powerful factor to make students motivated in the class.

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