A Collaborative Learning Environment in a Mathematics Classroom

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“Group work means more teachers in the room”

Abstract

The concept of team is pervasive within the United States Army but cannot be found with the same frequency in the world of academia. I feel that the same mentality that we have about helping one another to accomplish a goal and as leaders empowering subordinates to accomplish a mission has relevance in the classroom. Throughout the semester, I attempted to create a collaborative learning environment by structuring my classes in groups of three or four individuals. Throughout the semester, teams worked together both inside and outside the classroom in order to learn the material. This paper explores the goals of this activity, possible methods for implementation, concerns associated with such an undertaking, and the affect of collaborative learning in a mathematics classroom.

Background

During my first semester of teaching, on the first day of class, I professed my teaching philosophy to my cadets. It was centered on what I called the “team concept” and it consisted of four ideals that all began with the word “we”.

...learn together.
...support one another inside and outside of the classroom.
...share our ideas and thoughts but give credit where due.
...ensure every member of the team not only passes but excels.

I truly believed in every one of these statements and still do today. However, in my first year of teaching I did not understand that I had not facilitated the creation of a learning environment inside of the classroom which would allow for us to succeed in these pillars.

Methodology

During the academic semester 2010-01, I taught the first semester core mathematics course, MA103: Mathematical Modeling and Introduction to Calculus. It is traditionally an applied mathematics course in which students use modeling and problem solving techniques to solve complex and ill-defined problems. The course is divided into three blocks: Modeling with
Learn Together...

Throughout the semester, I had students work in groups for the majority of the activities in and out of the class. I determined the groups and configured the classroom into islands of three to four desks in order to facilitate the interaction of students and the true exchange of ideas. I determined that my responsibility would lie in establishing the classroom environment in which students could work together and learn from each other instead of relying directly on me or by trying to struggle with a problem in isolation.

After conducting research on the topic of how to best form groups, I decided to try three different methods. In doing so I wanted both to expose the students to working with different types of people with possibly differing learning styles and to determine for this group of cadets which method of grouping students is most beneficial to their learning.

Research suggests that more effective groups are formed by some method implemented by the instructor vice allowing the students to pick their own groups. Therefore, for the first block of the course material, I formed groups by location and similar interests. I had those students in the same company or regiment working together so that outside of the classroom they may be more likely to meet since they shared a common bond of their regiment and barracks location. For the second block, I reconfigured the composition of the groups by looking at a student’s overall grade in the course and sectioning them into three tiers. I then choose one student from each tier, creating teams which were evenly balanced with students from the top, middle, and lower end of the spectrum. Finally, I determined groups based off of their overall grade in the course, allowing those with like grades to work together for the last block of the course.

Additionally, I had the students take a learning styles inventory at the beginning and end of the course in order to see if they had grown as learners or if their learning styles had changed due to the cooperation demonstrated through working in groups. Additionally, I

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wanted them to realize that people learn in different ways and when working with others, the approach to a problem that you understand might not be the best way for someone else in the group. More importantly, I wanted them to see that the way that I as an instructor might teach a topic might not be the most beneficial approach for all students in the course. Therefore with them sharing their ideas and interpretations with each other, they would be able to learn more than by simply watching their instructor tackle problems at the board.

**Support One Another Inside and Outside of the Classroom...**

For each class I created either a discovery activity or a board problem sheet with challenging application problems for the groups to solve. I would always start class by reviewing the last classes’ material in order to make the link to the current lesson, answer questions from the homework from the night before and show them a sample problem to explain one of the more basic lesson objectives for the day’s class. After providing this framework for the lesson, I would then have the students work in groups for the remainder of the class, either at the boards or at their desks depending on the activity while I walked around and helped groups with questions that arose and could not be solved by the group.

My first response to a student who asked me a question was to inquire whether they had asked the same question to their teammates first. I wanted them to be the ones to assist and support each other when working on a problem, collaborating in order to come up with a solution or to discover the lesson objective. Throughout the remainder of class, there were times when I would bring the class back together to go over a tough concept, work a problem for the entire group or rehash an important discovery linked to a critical lesson objective. Then, at the end of class, I would follow up with a short pre-teach for the next day’s lesson in order to give them an appropriate focus for that night’s material and demonstrate how it was linked to the topic discussed that day in class. Students were encouraged to work with each other on the homework before the next day’s class.

The groups submitted one document for the entire group for all turn in assignments. There was always one problem due each week for 10 points. And one major graded assignment per each section worth up to 65 points. Additionally in the second section of the course, there was a group project that was due worth 150 points. The project was done with a member of their group from the first section, when the problem was originally assigned.

**Share Our Ideas and Thoughts But Give Credit Where Credit Is Due...**
Since the groups were established as formal groups, there was not a requirement to have documentation for any help received from a group member. However, in the course of the class, I would frequently have students who did not actually work on writing the answer to the problem either on the board or in their notes be the individuals to brief the group’s work to the class. I implemented with procedure early on to show that everyone is responsible for the material and to emphasize that the students should take pride in the good work that they had done together.

Additionally, when I was directing the learning at the beginning of class, I would call on students to answer questions along the way to make the entire experience collaborative. At times I would call on a group and ask that someone within the group answer the question. More likely, I would ask an individual a question, wait for an answer and then if the student did not have a response or gave a partial response, I would allow the student to use a life-line of a fellow teammate from within the group to assist and share their thoughts on the topic.

In order to show the students that I was serious about the team concept, I gave them a means to influence the flow of their course and influence their learning by sharing their ideas every Friday through what I called “Add, Subtract and multiply”. At the beginning of the period, all the students would take the time to comment on each of the three mathematical operations on a 3x5 card – sharing with me what they would like to add to the class, subtract or take out of the class and what they would like to continue, sustain, increase or multiply within the class. I would compile the results over the weekend and on Monday at the beginning of class I would share with them some of their suggestions and discuss how in the course of the next week I planned on incorporating one or two of the suggestions and how I thought that change would be beneficial to their learning.

In order to truly give credit where credit is due, I wanted to assess contributions amongst group members. Therefore at the end of each block, before making the change to the new group structure, I had each student conduct peer evaluations on the members of the group, including themselves. (See appendix for Peer Evaluation.) I wanted them to assign scores that reflected how they felt about the extent to which the other members of their group contributed to their learning or the overall group’s performance. They were given a total of 30 points for a team of three or 40 points for a team of four. They were not allowed to give all members 10 points. There had to be some differentiation in their ratings and they were asked to describe the reasons for the ratings as well.

*Ensure Every Member of the Team Not Only Passes But Excels...*
Since the majority of the in class and all of the out of class assessments were collaborative in nature, the majority of the grades in the course were group grades. I conducted six group quizzes throughout the semester in which I would give a problem to the group and ask for one submission at the end of the allotted quiz time. Additionally, as previously stated, there were three graded homework assignments and weekly submissions that were all done outside of the classroom as groups. However, the weight was such that only 25% of a student’s overall average was the direct result of group assignments. Out of the allotted 2000 points for the course, I was allotted 350 instructor points, all of which were used as group assessments, and there were 150 points allocated to the group project for a total of 500 points.

Throughout the semester we also played games with teams competing for bonus points or bragging rights. Teammates would compete together against teams at speed boards in order to see who could solve a computational problem the fastest. All members of the team could do the problem and the first one done would be able to buzz in with their answer on behalf of the entire team. Additionally, there were games in which the entire team could confer on an answer and when time was up all groups were evaluated on their answer and then awarded typically bonus points accordingly.

Of course, the points in the course that were tied to directly to group work were not the true focus of the class. The intent was that in completing these assignments as groups and not as individuals, true learning would occur that could then be demonstrated by an individual student on a major end of block exam or the term end.

Concerns

My goal in this research was to see if I could the team concept would work and if I could create a collaborative learning environment which would facilitate the achievement of these four discussed pillars. However, I had some concerns about turning my entire class into one focused solely around the strengths of cooperation. It turns out that I was not alone in my concerns. Felder and Brent discuss a few of my exact concerns in “Cooperative Learning in Technical Courses: Procedures, Pitfalls, and Payoffs”3. Before discussing the results of my research, I wanted to respond to my initial fears.

If I spend all my time in class on group exercises, I’ll never get through all the lesson objective.3 In teaching according to the Thayer Method, I know that the learning of all the

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stated lesson objectives is the students’ responsibility. However, I feel like I need to at least introduce them to all of the objectives while inside the classroom. Throughout the course, I was able to create small activities to at least introduce each lesson objective and then based on how far the groups were able to get on the in class problems, I would adjust that night’s assignment accordingly.

If I assign work in groups, some students will “hitchhike”, getting credit for work which they did not actually do. This was definitely a legitimate concern which was almost self correcting. I had each student read a portion of the Oakley article on hitch-hikers and couch potatoes in the middle of the first block of material and then each student had to contribute to a discussion we had the following day on roles within a group and how to handle individuals who are not doing their share of the work. Additionally, throughout class while I walked around to the groups to monitor their progress on a problem, I was able to easily spot individuals who were either not participating in the activity or who did not understand previous concepts need to solve the problems in the current lesson. I was able to talk to them about why and encourage them to work with their team to understand. At times I was able to convince them to come see me to get caught up or more likely, after major graded events, they saw that they truly had a lack of understanding and reflected on why. Most of the times they were honest in their assessment that if they had actually worked with their group on the problem I had given them, they would have understood how to tackle the problem on the end of block exam.

Groups might rely on one person to get the problem started and then on individual test they may have difficulties when they must begin themselves. For all in-class work and for all outside of the class assignments, I ensured at that every student had a copy of the board sheet or of the assignment so that they could individually work on the problem. In groups in class, I would encourage them to start on their own and then when someone got stuck, ask a group member for help. When I saw that someone wasn’t taking notes, I encouraged them to at least write something down so that they could reference it later on when they needed to reflect or study. Additionally, I encouraged all groups to make a photocopy of all returned graded events so that all team members would benefit from my comments. I also gave them time in class after I had handed back assignments to look at the assignment as a group and to ask questions.

What if the members of the group do not work together well or are not getting along. I did have an instance in one of my groups that the team dynamic did not work. I never changed the team members but instead talked to the concerned students individually about group dynamics and responsibilities in a group. The application to the Army in this case is so sound that it really puts it into perspective. They are going to go through this when they are leaders and how will they handle it? It’s a chance for them to grow as leaders.
What if I have students who do not like working in groups and feel like they would learn work if they were working alone\(^3\). This happened especially with the brightest students in my class when they were in groups together. I found that they rarely spoke and they were the ones with the feedback to me that complained about group work. I never forced them to actually complete work in the classroom as a group. Most of them, since they did not have problems with most of the material, did not exchange ideas in the classroom which was fine. Additionally, it probably matches with their learning styles and since I cannot address everyone’s learning preferences all the time I was not bothered by this situation. Instead, I still required them to submit one product for their homework submissions which required them to at least communicate, if not collaborate. I again emphasized to them the linkage to the Army and reasoned to them about maturing in their position and strengthening their leadership style.

Discussion of Results

I wanted to assess how my classes performed under each of the four pillars in order to determine if I was able to create a cooperative learning environment which was beneficial to all of my students. There were numerous methods that I used throughout the course in order to collect information and gain feedback. I will discuss how most of these contributed to my understanding of their achievements in collaboration.

Learn Together...

In the beginning of the semester, I had asked my students to take a learning styles inventory in order to possibly give them insight into how they learn which could be beneficial to them when working in groups. Although it would have been interesting to note their learning styles and maybe even form groups based on them, I was interested initially only in the possible change in learning styles throughout the course of the semester due to a collaborative environment. Therefore, I was interested in the Active/Reflective learners.

According to Soloman and Felder, “Active learners tend to retain and understand information best by doing something active with it”\(^2\). This was the basis of my class. Working on problems together and explaining them to one another was how I visualized the goal of learning together. Whether at boards or in their seats, all the learning experiences and problem sets were designed to give them time in class to engage with the other members of their groups and the new lesson material. I felt that this should assist the active learners and the balanced learners and maybe stretch those reflective learners into understanding and appreciating the power of the group.
Initially in August, after I collected the learning styles inventories, I found that I had 17 active learners, 15 balanced learners in this category and 10 reflective learners. After the entire semester of working in groups, I was curious to find that the overall distribution had not considerably changed: 18 active, 15 balanced and 9 reflective learners. Comparing individual scores, I found that 12 student’s scores had changed. Of those, most (eight) were only by one step. Only four students changed significantly to more active. Additionally, I had three students that had actually become more reflective learners. Of course, most of these changes are insignificant and are the difference between answering one flagged active/reflective question differently and there is always the influence of the entire body of development that has occurred throughout the semester at West Point.

This measure was not definitive to use in order to assess whether they had actually learned together – did collaboration work? Course end feedback would indicate that it had worked tremendously well for the majority of the class. An Academy level question to the students asks them to comment if “my fellow students contributed to my learning in this course” which is a perfect assessment for the team concept.

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n = 45 mean = 4.29 s.d. = 0.78

Table 1: Course End Feedback Comparison Question
The possible responses were [5] Strongly Agree, [4] Agree, [3] Neutral, [2] Disagree, and [1] Strongly Disagree. As compared to the spectrum of groups from the academy as a whole to the other sections of MA103, the responses from my students were at a minimum 0.14 higher. Of my 45 students who answered this question, 91% of them answered this question with either strongly agree or agree with only 1 student disagreeing.


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Table 2: Answer from course end feedback for ranking [2] Group Work

As seen from the table the majority of the students ranked it either second or third out of the eight possible options. But more importantly, the mean response came in tied for second ranking with board problem sheets (first was instructor doing a problem). This is significant in that students did see the value in group work and that did directly, in their minds, contribute to their success in the course.

Throughout the course end feedback results, I was pleasantly surprised to see the numbers of positive comments about group work. There were 20 responses pertaining directly to group work and learning together in response to the core math question of “If you can keep
one aspect of the math program the same, what would it be and why?” This question was meant specifically for the course as a whole although group work was done only in my sections throughout the entire semester. A few of these comments deserve sharing and reinforce that learning together truly was accomplished in my sections:

“Group work allows a contribution to the learning process.”

“Group work means more teachers in the room”

“The group work that we did was very beneficial. It enabled us to get to know each other as well as help each other out when we needed it.”

“Working in groups, you learn what you don’t know from people that know the subject you are confused on while they learn what you know on the subject that they are confused on.”

Additionally, one student was so excited about learning in groups that in response to “if you could make one improvement to the math program, what would it be and why?, the student states “I think that more classes should split up and work into groups like we did in my class. I learned so much, much more than my roommates.”

Support One Another Inside and Outside of the Classroom...

The goal to support one another was touched upon in the discussion above. However, I would like to augment it to focus on the information collected by my daily reflections in my instructor journal. In the course of the group work, I found both the creation of natural groups and leaders as well as a preferred method of sectioning based on this audience.

Beginning in October, I began to clearly see the comfort that most students had in working in their groups to the extent that before class started while the cadets were settling in the conversation was not always on the latest uTube video or the rumors about a particular cadet in the barracks. Students were excited about sharing with their other group members and me about their accomplishments in working on a problem either individually after working a problem like it in their groups the day before or as a group in the barracks. They began to take pride in their group work at the boards, comparing it with other teams. They also began being accountable for the other students in their groups, knowing if one of their members was going to be absent due to sickness or a trip section.
Additionally, I saw the ease in which students talked to those from their previous team or the individuals that were co-located in the barracks together. The bond of location proved to be stronger than the relationships with their current groups in class. Understandably, due to the nature of a plebes life, if they do not have to travel far to meet with a group member and when they do meet they have an already kindred spirit based on regiment or company, it make the connection and transition easier. On four occasions, project partners commented on how easy it was to meet with their partners to complete the project and wondered whether that group assignment was purposefully done. Of the three different strategies used for group assignments, I feel that the grouping based on location and common interest was the most successful.

*Share Our Ideas and Thoughts But Give Credit Where Credit is Due...*

Throughout the semester, the students were given a chance to input into the class as a whole and reflect on the group process. Through “Add, Subtract and Multiply”, I may not have gotten the feedback that I wanted for collaboration since it was open to whatever was on the student’s minds (Throughout the ten times we conducted this feedback, I received at total of 62 comments on group work from the 51 students in my class). However, I do feel that this was quite critical in student’s buying into the course and its conduct. They truly felt like it was our course together and that their input was considered and implemented. The bigger group of the entire class was at stake when they took pen in hand to provide this feedback to me because they saw it implemented for the entire class the following week. It was part of a bigger collaboration picture.

For example, one “add” issue that was addressed during one week in early October was to “add more teacher directed learning in the classroom”. I had received this from five students that week and therefore decided to highlight it in the next week of class. The students were told that I would be adding more directed activity initiated by me as the instructor doing some problems on the board while they assisted me. This significantly cut into the amount of time that individuals had to work within their groups on problems in class.

That Friday when I asked them again for “Add, Subtract, and Multiply” feedback, I received the following comments from 16 students (In this list, I have only included the comments that I felt were a direct reflection on the change to increased instructor directed learning and collaboration):

**Add:**

Ensure that we devote enough time to do at least 2-3 problems in class
More examples of problems like you walking them out step by step
Harder problems and more time to do them
More word problems so we can see and do more applications of the material
More group work
Going over homework problems or at least time to answer a few questions

**Subtract:**
Relying on plebes to learn from the book, they need to do problems to learn
Board problems in groups because it doesn’t help unless you already know how
A little less time with lecture
Large amt of group work because it prevents people from learning themselves

**Multiply:**
Working on problems in class/group work
Group setting is good
Group tables, group problems, going over examples together in class
Making us teach one another within the classroom
Class is interactive
Opportunity for practice
Practicing problems in class
Keep doing problems in class, but give us time to record in notes

Based on the above comments, all of which I shared with my students the following Monday, we talked about how we can balance instructor directed teaching with the desire for more practice, more interaction. We came to an agreement that I should only ever do one problem for the class and in doing so I need to take input and ask the class to contribute while I work it out so that we can learn as a big group. It gives them time to practice and learn the other concepts together and get to the applications that they demand.

Reaching this conclusion together was paramount into achieving the team concept and giving everyone the opportunity to contribute and share their ideas – true collaboration at its best. Now it did not always work this perfectly and I did spend a good amount of time with the discussion, but in the end, I think it worked to the advantage of the entire class in moving towards a collaborative environment.

Another metric that I used to help assess this pillar was in the peer evaluations that we conducted at three points in the semester, upon the conclusion of each block at the point where we changed team composition. I have included the peer evaluation form that I used as an appendix to this report. It had two sections: one for the actual peer review in order for
students to give credit to those who had been true contributors along the way and the other for an assessment on how we were working in groups.

For the peer evaluations, I received feedback on the others in the group as well as an honest self evaluation from many of the students. In the comments section of the peer evaluations, I saw the willingness to comment increase as the semester went on. For the first set of peer evaluations, although a requirement, many students either did not make comments to describe their ratings or were not specific in their input. However, as the semester went on I received more comments and more importantly, more insight into team roles and preparedness for class.

Group leaders were identified in the comments and were generally agreed upon by the entire group. I was able to determine who the group thought was most helpful for technology support questions and who was the determined scribe. Based on this input, I went around in following lessons and looked at notebooks and technology files. Every day for the next week, I made comments in my instructor journal and then compared those comments to the peer evaluations. On October 20, I commented in my instructor journal that only one student per group had the previous days problems completely written out. In all except two cases, this matched with what the peer evaluation consensus was on who the scribe of the group was. Group work may have been working for in class learning but three fourths of the class was not bringing a complete written product back with them to the barracks for either reflection or study.

The same was true with accompanying technology files. Of all my groups (14 total), only three groups during that same week, had more than one member who had worked the problem in Excel in its entirety. The majority had just written the answer on their board sheet. I explained to these groups the importance of the group effort to get the correct answer is only one component. More importantly, they should be working together so that they all have the understanding and therefore will all be able to tackle similar problems on their own. This caused me to worry if I was doing a disservice to some for an upcoming individual assessment.

As mentioned, the second portion of the peer evaluation form was a series of questions on how we were working in groups. In the first question, I asked “Did you learn from being in a team during this block? How?” Most of the responses were affirmative with at most four negative and six neutral during the three times this question was asked throughout the year. The most insightful of the comments dealt with team dynamics and the benefits from teamwork which was good to see the students relating this to a life outside of the classroom.
Comments included insights into communication, sharing of ideas, complementary working with the strengths and weaknesses of others, others there for help and support, and the coordination of conflicting schedules outside the classroom. I had three total comments concerning preparing and knowing the subject matter to ensure you were not “letting down the rest of the team [which is] more than just yourself”. Additionally, the greatest benefit to being in a team is actually teaching others, not just taking as seen from the following comments from two of my students in my class who received the highest averages and were classified by the learning styles inventory as reflective learners:

“Yes, by being in a team, I had to teach my team members. Teaching a subject proves that you know the subject.”

“Yes, just explain something to a group member a problem he didn’t know allowed me to solidify the information for myself.”

I would conclude for at least these two individuals that although they were classified as reflective learners, they both have seen true benefit to working together in order to learn.

The second question stated “How can I make group work better for your learning?” The responses ranged but there are a few that I would like to comment on. There were a total of seventeen responses that indicated to let students choose their own groups, of those three students made the same statement on each of their peer evaluation forms. Additionally, there were ten comments on the size of a group of four being too large. Those statements, coupled with the comments that I had written at several points in the semester in my instructor journal have lead me to conclude that a group of three students is better for an exchange of ideas than a group of four at this level. Throughout the semester, I found that groups of four tended to break off into two groups of two. Additionally, in the groups of four, it was easier for a student to get by not contributing to the group and at times there was not enough work for a group of four.

Ensure Every Member of the Team Not Only Passes But Excels...

On first look, there really is only one way to evaluate this pillar – did all my students pass the course? And then, how well did they do in comparison to others (i.e. did they excel)? Well, we failed on the first count. I had two course failures and I had one student who earned a D and elected to take the course again in order to better understand the material. Since I currently teach the group of students who are retaking MA103 for a second time, I have had the opportunity to talk to each of them on why they feel they failed and what we can do better
this semester to assist them in their learning. None of them specifically reference working in groups as a hindrance to their learning. In fact, the student who had chosen to grade replace wanted to make sure that we were going to work in groups this semester because it was what he appreciated the most. Of these three students, all three were designated active learners based on the learning style inventory so the hope was that, if anything, they benefited from the active, collaborative environment in class.

The final quantitative measure I used to evaluate this pillar and then the effectiveness of the team concept as a whole was to use their grades on their individual assessments and compare them to the average grades for those events in the course. Now, I do not think that it is reasonable to be able to make specific claims that group work contributed directly to a success or to a failure in this case but it is interesting to note and some conclusions may be drawn. However, if my groups were consistently below expectations than that could be an indicator that either my attempt to create a collaborative environment was unsuccessful or that the students were actually disadvantaged by working in groups. The opposite could hold as well.

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<td>78.06%</td>
</tr>
<tr>
<td>Project</td>
<td>83.00%</td>
<td>90.49%</td>
<td>81.79%</td>
<td>82.43%</td>
</tr>
<tr>
<td>TEE</td>
<td>74.34%</td>
<td>85.04%</td>
<td>78.93%</td>
<td>80.87%</td>
</tr>
</tbody>
</table>

Table 3: Students grades in individual major graded events compared to the course

My A Hour class was sectioned to be a low class and by the course’s sectioning algorithm it was the ninth lowest class in the course. The other two sections were both middle by the sectioning algorithm and so I would have expected them to at a minimum match the course average – of those my C hour was upper middle.

In looking at the results for A Hour, I see that all their averages fall below the course average but as the semester went on the difference between their section average and the course average decreased, showing improvement throughout the course. For my C Hour class, my expectations were exceeded for all events besides the WRIT in which the class average was two points below and for my D Hour class, they matched the course average in all events.
besides the WRIT. It is interesting to then look particularly at my C Hour class and see that of the 18 students in that class, the learning styles inventory for half the class classified them as active learners and for six of the students as balanced. Two of the reflective learners in that section, were the two with the highest course averages in the end and they both are the students who made the comments on teamwork previously indicated in this section.

Conclusions

I successfully created a cooperative learning environment in which the majority of the class thrived. I feel the majority of the class appreciated it and many expressed the desire to continue collaborative work in other endeavors while at West Point. However, as the learning styles inventory results indicate, I had a significant portion of my classes who were reflective learners, preferring to learn by thinking about a problem individually in order to understand a new concept. Additionally, I had other students who never wanted to accept the possibility of learning from peers and instead preferred to listen and watch me do problems at the board. I found that a question that these individuals would readily raise their hand and ask me as they were working problems in groups, was on that would make them uncomfortable asking to their peers.

In the end, I got to know my students and could treat each of them as individuals, knowing those who were well suited to work and learn in their groups and those who I would need to address and assist while they worked in groups. Everyone learns differently and I feel that by putting students in groups, students are more likely to succeed because they are exposed to more types of approaches to a concept or a lesson. They are more likely to gain exposure to the type that works for them.

I do feel that for a first year population, the most successful groups are probably groups of three and are formed by either considering their location or interests. Therefore, in the future, I will continue to do group work in class and I will always section this population by like regiments due to an ease of meeting outside the classroom and an automatic bond due to their shared interests.

Based on my experience, I feel that using groups inside and outside the classroom assisted in the student’s understanding of the material and gave them additional confidence in their abilities to truly learn math.
References


