Collaborative Learning Experiment

By Christopher M. Smith

This paper was completed and submitted in partial fulfillment of the Master Teacher Program, a 2-year faculty professional development program conducted by the Center for Teaching Excellence, United States Military Academy, West Point, NY, 2010.

Introduction

In the Army, an example of leadership is empowering subordinates to accomplish missions, while supervising their work. I believe this approach has some relevance in the classroom, especially for instruction at the United States Military Academy. To that end, I want to determine any benefits from being a member of a formal group (complete with contracts of expectations). Specifically, if it affects the grade performance of individuals, the student’s usual level of preparedness for class discussion, self esteem (both in math class and individually), and individual class participation. The classroom procedure that I put in place used group theory to try to improve understanding and confidence in the concepts of my math class.

Classroom Procedure

During the academic year 2009-01, in the class I taught, MA206: Probability and Statistics (168 students), I assigned formal groups in my classroom. By assigning groups the cadets would be in for the semester, according to the West Point Dean’s Documentation of Written work, cadets no longer have to document help received from a group member.¹ After conducting some research, I found that most effective groups are formed by some method from the instructor, not from allowing them to pick their own groups.² With this in mind, I formed the groups by looking at all cadets within a section’s CQPA (cumulative quality point average), and separating them into three tiers, upper CQPA, middle CQPA and lower CQPA. Each group of three cadets within the section was formed by choosing one cadet from each of these tiers. The groups were assigned for the semester and were required to complete a contract of expectation that they all signed. In addition, I assigned seating in the class and made the groups sit together. Within the groups, I had them assign themselves one of three jobs for the functioning of the group, and had them include these assignments in their contract. The jobs included a coordinator (or team leader), recorder (typist of final documents) and checker (double checks solutions, turns in assignment). They remained in these jobs for the duration of the semester.

¹ Dean’s Documentation of Written Work, Office of the Dean – Academic Affairs Division, 2009. Pg4.
The groups must feel there is a carrot for positive activity/function and a stick for negative function. The carrot for each group was that for individual evaluations (1 WRIT, 2 WPRs in the course), if the group’s average letter grade in the assessment is higher than the group’s average letter grade of their CQPA at the start of the semester, they will earn 10% of the evaluation’s worth in bonus points. For example, the WRIT in the course is worth 50 points. If a group’s average CQPA grade is a B and their average letter grade on the WRIT is B+, they will earn 5 bonus points. The course only has 1000 points, so the prospect of earning 30 bonus points (WRIT: 5, WPR 1: 10, WPR 2: 15) is a bonus of 3% to their overall grade.

On the other hand, there is a consequence for non-performers within the group. If the group decides that a member of the group is violating the terms of the contract they all agreed to, they may request a meeting with the instructor. After discussing the situation with all members, if a solution cannot be agreed upon, the non-performing group member is fired from the group. This means that the fired member must complete all group assignments individually or be added onto another group (with instructor and new group member approval, and new contract). Therefore the stick is the potential of doing more work by themselves.

I used the groups not only for project partners (2 projects in the course), but also for group work in class. I frequently gave board problems or problem sets that I allowed the cadets to work in their groups either at the chalkboards or at their desks, but working together. In addition, if any group member was absent and I passed out board problems, it was the responsibility of the group member(s) present to get a copy of the board sheet for their absent group member. This allowed them to have responsibility within their groups and created an effective support group when they were absent or didn’t understand something from class.

**Evaluation and Analysis**

There were a number of ways that I measured the result of the classroom procedure, but for the purposes of this paper, I will explore only the first semester that I used this method (AY09-01). Throughout the semester, I collected information about and from my students as well as monitored their progress throughout the course.

In the course, MA206: Probability and Statistics, the fall semester is our off-cycle term. The majority of the cadets we see during the fall semester are advanced math sophomore cadets. Instead of taking the usual four classes of core math, they have taken an accelerated three class core math track. MA206 is the last class in their core math sequence. Additionally, about a third of the students are junior cadets who either couldn’t take MA206 during their spring of sophomore year or failed either MA206 or another math class and are behind in their sequence. There were 207 students in the
course, and sections were ordered by CQPA within each hour. There were high CQPA sections and low CQPA sections. I had two sections with average CQPA above the mean and two sections with average CQPA below the mean when compared with cadets in the course that semester. The relevant statistics are listed in Table 1.

<table>
<thead>
<tr>
<th>Number of Cadets</th>
<th>B Hour</th>
<th>C Hour</th>
<th>G Hour</th>
<th>H Hour</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average CQPA</td>
<td>3.43</td>
<td>2.74</td>
<td>3.69</td>
<td>3.08</td>
<td>3.18</td>
</tr>
</tbody>
</table>

Table 1: Statistics of my hours and the course

During this semester, I asked the classes to take a learning style test, which scored them along a scale of 4 types of learning styles (Active/Reflective learners, Sensing/Intuitive learners, Visual/Verbal learners, Sequential/Global learners). This let me get a baseline understanding of my 66 cadets and the various methods of learning that resonated with them. The results are presented in Table 2.

<table>
<thead>
<tr>
<th>Active</th>
<th>Balanced</th>
<th>Reflective</th>
</tr>
</thead>
<tbody>
<tr>
<td>40%</td>
<td>42%</td>
<td>18%</td>
</tr>
<tr>
<td>Sensing</td>
<td>Balanced</td>
<td>Intuitive</td>
</tr>
<tr>
<td>37%</td>
<td>45%</td>
<td>18%</td>
</tr>
<tr>
<td>Visual</td>
<td>Balanced</td>
<td>Verbal</td>
</tr>
<tr>
<td>61%</td>
<td>30%</td>
<td>9%</td>
</tr>
<tr>
<td>Sequential</td>
<td>Balanced</td>
<td>Global</td>
</tr>
<tr>
<td>39%</td>
<td>51%</td>
<td>10%</td>
</tr>
</tbody>
</table>

Table 2: Learning styles of my sections AY09-10

From understanding the learning styles of my cadets, I know that my sections were largely Active/Sensing/Visual/Sequential learners. Although it’s interesting to know the various learning types my students, specifically, it’s important that they are either Active learners or balanced between Active and Reflective. According to Soloman and Felder, “Active learners tend to retain and understand information best by doing something active with it,” like working on problems together and explaining them to one another. When I formed the cadets into groups, I frequently gave them problems to work either at the chalkboards in class or at their desks with their group members. This gave them time in class to actively engage with each other and the new

---


material. This should have helped those Active learners and those balanced between Active and Reflective to digest the new material.

Once I had a picture of the cadets I was working with, it was important to see and measure effects in the classroom. Since I’m not comparing results between sections (I don’t have a control section and an experimental section), I will only compare results to other classes as a whole to show that they were performing at or about the average of what we’d expect. I collected a fair amount of quantitative and non-quantitative data to attempt to measure the effectiveness of groups in my classrooms.

One of the qualitative measuring techniques I used was taking notes on the respective responsiveness of groups in class throughout the semester. It provided me more of a historical reference that I can review and come up with a general notion of how the groups were doing in my classes, rather than a specific analytic metric that I can measure. Initially, as one would expect, the groups did not necessarily jump to working together, but as the semester wore on, I found that they enjoyed group working time. It was a way of breaking up the traditional lecture time and turning the class and learning over to cadets teaching other cadets. There were some teams that were not functional, but after some counseling, I found that we worked out any issues.

Additionally, I gave the cadets a mid semester AAR on the course. I first asked them to rank the class from 1-5, one being the worst class they’ve taken, 5 being the best. The average grade was 3.16 with a standard deviation of 0.6, which to me is pretty favorable. I then asked them 5 questions: 1) what do you like about the course, 2) what do you not like, 3) what do you want me to change in my teaching, 4) what do you want me to keep the same, and 5) what could you (the cadet) do to better improve your performance in the class? In every class but one there were favorable responses to question 1 that involved the groups in class. Some examples were,

“I like working handouts in class in our groups, …having groups, and not having to document help from each other, …my project partners are awesome, … like working problems with group members to help…”

Due to the free and open nature of the question, the fact that these favorable responses made it down at all is notable. In addition, there were no negative responses about group work.

Moreover, in the last two weeks of class I asked the cadets to give their group a grade (again from 1 to 5) and give a sentence that explained that grade. Also, I asked them to evaluate the group’s usefulness with a grade (from 1 to 5) and provide a sentence that explained the grade. The cadets gave their groups an average grade of 3.78 with a standard deviation of 0.8 and they gave their groups’ usefulness a grade of
3.40 with a standard deviation of 1.1. Based on this and the comments, I think that on average the cadets liked the groups. It often forced them to meet someone they might not have met otherwise, and work together. Those that took advantage of the group for learning tended to grade their group’s usefulness higher, while those that only met for their projects tended to grade their group’s usefulness lower. I think this paints a picture of a classroom procedure that the cadets liked and, if they used it properly, an activity that they learned from and thought of as useful.

One of the things that was not a specific intent of my classroom experiment, but I found as a byproduct, was the effect of a chain of command or at least a support group within the class. As the instructor, I was not singly responsible for getting absent cadets missed information, keeping up with cadets who were falling behind, or for organizing the class. I found that within the group, they would often know about the accountability status of another: “Sir, John’s not going to be in class today, he took off for a choir trip section today,” etc. Working with the groups helped to take some of the pressure off of me for making sure cadets were responsible for their own learning. Since they earned bonus points if they performed well on individual events, the teammates tended to help each other out more.

The final quantitative measure I used to make sure that I didn’t disadvantage my cadets by trying the group experiment was to explore their final grades and compare them to the average final grade for the course. You can see these statistics in Table 3 below. I don’t think it’s reasonable to state that putting them into groups helped their final score because there can be so many other things that affect this grade. But since I’m the only one in the course that worked with groups, if my groups were consistently below the course average, I think that would be an indicator of disadvantaging my cadets by using the groups. In looking at the results, I think their final grades indicate that using the group learning methodology in class did not negatively affect their final grades.

<table>
<thead>
<tr>
<th>Number of Cadets</th>
<th>B Hour</th>
<th>C Hour</th>
<th>G Hour</th>
<th>H Hour</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average CQPA</td>
<td>3.43</td>
<td>2.74</td>
<td>3.69</td>
<td>3.08</td>
<td>3.18</td>
</tr>
<tr>
<td>Final Grade (%)</td>
<td>90.8</td>
<td>82.89</td>
<td>93.61</td>
<td>85.73</td>
<td>88.14</td>
</tr>
</tbody>
</table>

Table 3: Cadets' final grades compared to course

The last method of evaluation was in the course end critique. I specifically asked the question, “Please write any suggestions for improvements of groups based on working in them all semester.” Since almost all of the suggestions were ideas to change the group experience, not to cancel the groups, I consider that a very strong positive message. The vast majority of the comments for improvement revolved around group members being able to pick their own groups. Although there were a few who
didn’t like the contracts, or who didn’t like the groups, e.g., “I thought the writing of the contract was a bit ridiculous and unnecessary, the group system did not play a vital role in my development in the class…,” the majority of responses were favorable, e.g.,

“Small groups were very helpful…, I believe the groups helped me out greatly…, I don’t have any suggestions because I had a great group…, the groups work well.”

In addition, when we asked “If you could keep one aspect of the math program the same, what would it be and why?” though most of the comments related to the course, some of their comments related to their groups,

“Having groups that we can work together with…, the groups because they contributed a lot to my learning…”

I think because of the free response nature of the question, the fact that some cadets included their favorable comments about groups makes a powerful statement that they liked and learned from their groups.

Conclusions

On the whole I think my classroom procedure worked very well. The cadets seemed to like and respond to it and it certainly made some aspects of teaching easier for me as an instructor. I’ve used this procedure for other sections I’ve taught here at West Point, continually trying to modify it based on cadet feedback. I think that this procedure is not the panacea for student learning, but it fits with my teaching style and a majority of the cadets’ learning styles. Based on my experience and analysis of the data I collected, I think that using group practices in my classroom helped cadets both understand the material and gain confidence in their ability to learn and understand mathematics.
References


