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**THE EFFECTS OF CHANGING GROUP SIZE IN MY WORKSHOP
IN FUNDAMENTALS OF MATHEMATICS**

JULIA RIVERA

In a mathematics classroom, students tend to sit and look at their cell phones, not interacting with their peers. When solving math problems, students will work at problems by themselves, even when they need help from the professor. Yet students will not ask for help, and find themselves unable to solve the problem. A way to break this cycle is through weekly workshop sessions, where students interact with each other in a group. As a Peer Leader for the first-credit bearing mathematics course, Fundamentals of Mathematics (Math 1175) at New York City College of Technology, CUNY in the Spring 2014 semester, I became aware that working in groups meant using theories of group formation.

Tuckman's & Jensen's (1977) five stages of group formation describe how people in groups, no matter what kind of group it is, will go through a set of stages in order to achieve an effective collaboration. Bruce Tuckman originally examined various groups for small group military training purposes. After his theory of group formation was first published in 1965, it was frequently cited. The five stages are frequently referred to as "forming, norming, storming, performing," and "adjourning" (added in 1977).

The *forming stage* occurs in the beginning of group formation. When group participants first meet, whether they are students or business people, they get to know each other by sharing information. Each member of the group begins to identify the individual characteristics of other group members. Icebreakers help this process, where the goal is to get everyone comfortable with one another and let the timid people come out of their shell. In the first workshop I wanted everyone to get to know each other so that they would not feel awkward but rather that they would feel comfortable with the people they worked with. Once everyone shared something about themselves, they moved on to the task that needed to get done, which was to complete the math modules (problem set) for the week. After a successful first workshop, I realized that Tuckman's forming stage had occurred.

After a couple of weeks went by I noticed some progress from students where they were interacting and helping each other with the math problems. Once there was progress, my workshop suddenly hit the *storming stage*. This is common after the forming stage because group participants start to question and argue about a specific topic. The storming stage occurs when there is conflict among group members, where team members express their differences, especially where some members of the group are not contributing or putting in effort on the work, or where one person may have power over the team and there is unequal sharing of power among the group members. Conflict usually arises due to differences in expectations regarding agenda, leadership; competition and aggression are exhibited.

The first time my group encountered the *storming stage* was during the fourth workshop. A pair of students encountered a problem in the math module. As I tried to help them I was also uncertain of the solution to the problem; each one appeared confused and anxious in trying to solve the problem. They started to disagree whether their solution was correct. This not only brought conflict among my group members, but this also brought awareness that there was conflict. As the Peer Leader, being in this situation was a bit nerve-wracking because I felt like I did not know what to do.

Cheung (2012) explained that students will argue to defend their way of completing a problem. As a Peer Leader, Cheung put a chemistry problem on the board for one student to solve while the rest of the group members were the judges. As the student presented the problem another student disagreed, and that's where the conflict began as to the solution to the problem, and who was right and who was wrong. At this point, Cheung's group was in the storming stage. As I also encountered the same problem, I felt the same way Cheung felt on how to go about the situation. There were millions of ideas running through my mind in how to control everyone and figure out a solution that would be satisfying to the students. As I was trying to fix the problem, the students ignored me and continued arguing.

Just as Cheung was at the edge of giving up, a miracle happened that had not been mentioned in Tuckman's storming stage. The two students stopped arguing, there was a discussion of the two solutions although it was not an aggressive discussion. They had reached an understanding and agreement which was a great relief for Cheung, as well as a learning moment for the two who had disagreed, and all the group members. As for my group, one female student explained how she found a solution to the problem: it was a good approach and understandable, and the group became calm. With the calm, the group members turned to the female student and started working as a whole group. Although my students argued, clearly in the storming stage, they made a step forward in learning just as Cheung's students had done. As he wrote, "Arguing is a great way for ideas to get exchanged, when students argue they will use the best of their knowledge to defend themselves," and this is how students benefit and learn from one another. When students argue they tend to reach an agreement where they end up learning something new.

Although Tuckman's theory helps identify the stages, it does not state the possible learning achievements for students within each stage. As Cheung noted this omission from Tuckman's discussion, he himself had learned that argument is essential to group learning because it helps team members become aware of their learning process, the material, how they learn, and how they benefit from each other's ideas, which also underlies the group dynamic. Although students go through self-oriented behavior (Dixon, 2012) and through the storming stage, students are able to take the initiative to fix the problem and make a step forward in learning.

The aftermath of the storming stage is known as the *norming stage*. The norming stage usually follows the storming stage where the team members resolve their differences and reach an agreement on how the group operates. This is when the students start to brainstorm and develop ideas in an organized manner and where task assignments are made based on abilities and skills. Sharing, trust, and skill building is what usually occurs during the norming stage. This stage occurred after the female student found the solution to the math problem that everyone was stuck on. I asked her to explain to the workshop group members how she got to the solution, and she showed and explained how she obtained the answer. After she presented her solution, the other students decided to work as a whole group and they continued

working together in finishing that week's module. As a Peer Leader, I was thrilled to see my group working together and that they each had assigned tasks to reach their goal, which was to get the math modules completed. It was a good feeling because not only did my group learn something after the storming stage, they were able to take that learning experience and apply it to the workshop, where they created a stronger bond and assigned responsibilities to get the task done.

As weeks and workshops went by, students started to become independent of me and collaborated with each other in completing the modules. Groups that become independent of their leader are considered to be in the *performing stage*, where team members collaborate and become more productive in getting the task done. The performing stage is the most productive because that is when students are able to use their skills and apply them in their group, having learned to rely on each other while being independent from their leader. As a Peer Leader it was exciting for me to see my students in the workshop learn from each other and discover new skills while they obtained different pathways to solving a math problem. This showed me that everyone in the group was completing their goals and progressing from when they first started in workshop.

As it was the final week of workshop, everyone in the group was happy and relieved that they completed the task, and were able to create a bond where they learned from each other, gained new skills and expanded their knowledge. When a group has finally completed the task and the team's time together has come to an end, the group has come to the *adjourning stage*. This stage is the ending of the group where we say our goodbyes. This stage will always occur after an effective collaboration because every group and individual has to move on to meet and interact with new people where they can then expand their knowledge and share ideas. This final stage is a recognition of the work and effort the group has put in, in completing their tasks and moving on to the next challenge. That is why as a Peer Leader I decided to buy them pizza in celebration of completing the semester and achieving their goals. I saw my group of students progress and their work ethic improve: they deserved pizza!

While learning about the five stages in Tuckman's theory of group formation, I also looked at Dixon's (2012) discussion of group behaviors, based on material from the Leader Shape Institute (a college program for student leader development). As the weeks went by and the workshops continued, I noticed that some students were stronger in math than others. I decided to split the whole group up into groups of three based on their knowledge. Stronger students were grouped with weaker students so that there was a balance of abilities in the group. The smaller groups allowed the students to be more involved and interactive when solving math problems, and this also provided a method of accountability where the students would not fool around. I also did this because once everyone started to be more comfortable with each other, students were not focused on the topic and some were messing around and making jokes. Changing the grouping was a way to change the dynamics that affected behaviors. Dixon's description of behaviors in groups was evident in my students.

Group dynamics is the way the group progresses through the stages from getting organized to being active and productive. Dixon (2012) states that, "Groups often tend to concentrate on task functions without addressing interpersonal relations, but both issues need to be dealt with for efficient and healthy functioning." Because students have their own individual characteristics, in order to achieve a positive group dynamic the Peer Leader needs to be aware of behaviors to work with the group.

In order for a group to be successful I had to look at the group's behavior within each stage. I had to see how individuals in my workshop behaved toward each other and how their behavior affected the

group's behavior and its functioning. Dixon described three behaviors: Task-Oriented Behaviors, Maintenance-Oriented Behaviors, and Self-Oriented Behaviors. *Task-Oriented Behaviors* are those that keep participants on task so that they can accomplish their goals. Group members usually seek or give opinions or information, elaborate by listening, and summarize by putting ideas together. Usually the group will start using a task-oriented behavior where I would guide my group into helping one another and helping them figure out how to solve the problem. I had to keep them on task until the group was able to go on their own, which would usually happen during the norming and performing stages. *Maintenance-Oriented Behaviors* are those that assure that the group maintains a good working relationship and continues toward its goals. This includes gatekeeping by keeping communication open, encouraging by making sure information is shared with warm responses, and compromising.

Self-Oriented Behaviors usually occur when the group is in its forming and storming stage, where the task at hand is difficult and stress is created within the group. Individuals may exhibit aggression where students criticize or blame another group member; *blocking* where students interfere with other topics and not the one they are assigned to, basically going off on tangents; *manipulating* where one has his own ideas and interests rather than the interests of the group; *seeking attention* where one can have an extremely loud behavior disrupting the group's progress; *competing* where one tries to rival others in an effort to look more helpful in order to gain favor from the group leader; *withdrawing*, not being focused, daydreaming, doing something else other than the work that is assigned.

Task- and maintenance-oriented behaviors can be productive and necessary for creating a cohesive group, but self-oriented behaviors are disruptive and should be avoided and discouraged. Peer leaders should recognize the first two behaviors which are necessary to ensure that the group stays on task and functions effectively. The way I was able to manage my group was by changing the grouping each workshop. I assigned the weaker students to work with the stronger students so that each group can be balanced so that everyone can work together effectively. An important skill Peer Leaders need to know how to do is identify when a student exhibits a self-oriented behavior. This occurred in my workshop. There were a couple of students going off on tangents and talking loudly, disrupting the group's work. To resolve this I rearranged groups and separated the two students. This was a good solution because not only was there no further interruption but both students were doing the work. Sometimes there is one student who still disrupts any group; the best way to deal with this is to have him write a problem on the board. This helps that student become aware of his learning abilities, and if there is a problem his teammates can help him with the solution.

I believe that Peer Leaders should help students identify positive behaviors and guide students toward task and maintenance behaviors, which can benefit both the student and the group to function well. Toward the end of the semester, I asked two students who had completed their modules to be my assistants and help other students who were having some trouble, and they were enjoying this new role. All the students' performances were progressing. Every hard worker deserves a reward, such as pizza at the end of the semester, especially after achieving a goal.

One of the fundamental aspects in structuring cooperative learning activities is the size of the groups. Bertucci, Johnson, Johnson & Conte (2010) have investigated the impact of group size with inexperienced cooperative learning groups. They measured the effect on achievement, self-esteem, and social support. They found that grouping students in various configurations allowed the students to solve problems,

share ideas, interact, and complete tasks when working. However, there may be some difficulties for group members to develop the procedures and skills needed to work together, unless the Peer Leader is aware of the stages of group development, and concurrent development of processes for positive group dynamics. Working in groups is helpful for higher achievement; even working in pairs and trios promoted higher achievement than when working individually. As Wheelan (2009) stated, "Group productivity in changing group size increases students' high self-esteem." As workshops continued, I kept rearranging the grouping of students and having different group sizes so that students could perform and work well together, and as a result, this positively impacted the students' levels of achievement.

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