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Effective Group Work in a Mathematics Classroom

## **Introduction**

The paper topic I have chosen is effective group work. I have chosen this topic because in the future as a teacher, I want to structure my math classroom around group work. There are many benefits to group work in a mathematics classroom if it is implemented effectively, but this takes some practice and may depend on the students, teacher, and topics. There is a lot to be said about effective group work and it seems to be somewhat of a gray area since there is no way to be exactly sure what effective group work entails.

This topic is of great interest to me because group work in a mathematics classroom is something I never experienced for myself until I started taking mathematics education courses here at the university. All my mathematics courses prior to coming to UGA were structured the way a typical classroom is thought to be. As the students, we sat in desks that were spaced out individually in the classroom and took notes while the teacher lectured from the front of the room. The mathematics lecture from the teacher consisted of telling us the procedures for the topic and then the teacher leading practice problems or examples for us to write down.

### **“Effective” Group Work**

What does effective group work even mean? The goal of group work for both the teacher and students should be to gain and build knowledge together. Solving problems in groups involves each person in the group contributing and listening to each other. Even if their ideas may not be “correct”, group members should still reflect on these ideas together. Everyone must understand the work being done and come together to agree on the problem through good discussion while working on it (Webel 2013).

Students and teachers have only slightly differing ideas about the characteristics of effective group. They generally agree that effective group work involves collaboration and sharing mathematical ideas and understandings where students are helping and supporting each other rather than the teacher doing so. They both also believed that cooperative group work should be a good opportunity for social interactions and active participation. Students put slightly more emphasis on the social aspect of group work when describing it. They think it is effective when the group members like each other, are able to help each other, and when the problem or task is completed by the group. Teachers on the other hand, seem to focus the idea of effective group work more on the mathematical task aspect. They think it is effective if the task covers the mathematical curriculum thoroughly (Mulryan 1994).

There are certain aims or focuses involved with solving the mathematical problem at hand and when reached, make the group work effective. Solving problems is said to be the whole group's responsibility. It emphasizes certain behaviors from students such as resolving disagreements, collecting ideas, and wanting to be convinced of mathematical ideas and claims. Effective group work does not mean that the only things students are doing is getting and/or giving help. If some students are getting help by seeking out the so called experts in their group who are giving them the help or doing all the work, this is not productive (Webel 2013). Separating group members with certain labels such as help getters and help givers takes away from the effectiveness of working together as a whole for full mathematical understanding.

### **Rationale for Group Work**

Why should we even bother implementing group work into mathematics classrooms? Effective group work can help students to raise their mathematical levels of understanding. This idea of mathematical level raising refers to moving from one level to the next of van Hiele's

three levels of mathematical understanding. It has been found in one research project that level raising can occur most effectively through a “process help” teacher intervention (Dekker & Elshout-Mohr 2004). The implications of this process help intervention will be discussed in greater detail a little later.

Having students work together in small groups has many benefits that will not come from a teacher centered or lecture style classroom setting. Group work in a mathematics classroom can have both positive cognitive and noncognitive results for students. Working in groups has shown improvements in student achievement and has helped students to grow in their interpersonal relationships. Effective group work can be and should be used to try to enhance higher order thinking skills of students and improve their problem solving abilities (Mulryan 1994). In other words, group work is a great learning opportunity for students mathematically as well as socially (Allen 2012).

If group work is effective and implemented correctly, students should gain more mathematical benefits from it than in a traditional teacher centered classroom setting. Through group work, students have more opportunities to express their thinking and exhibit deeper mathematical understanding and retention of concepts. Their own mathematical strategies can improve because they are able to incorporate the ideas of their peers. During group work, students will not be as isolated and may feel less anxious or nervous about doing mathematics (Allen 2012).

Learning mathematics is the main focus of group work, but there are also social benefits that students will gain by working collaboratively. Effective group work can teach students to communicate with others and create a position in an argument by using objective facts to back themselves up instead of trying to persuade through emotions. Group work is a great way for

students to learn how to work in a team environment which is a key skill to have in life and for their future. Lastly, through effective group work, students learn to respect each other and the differences they may have amongst group members such as varying races and socioeconomic statuses (Allen 2012).

## **Disclaimer**

If effective group work is so beneficial, then why is it not seen more often in a mathematics classroom setting? Even though research has been done on its many benefits and pointers for teachers to implement group work, there is a gap between the research and actual practice of group work. Some turnoffs that teachers have related to group work is that students will not take it seriously, strong students will do the work while the weaker ones will coast through the task, some students would rather work alone, or there are too many students in the class to do groups. These things reflect why successfully implementing group work will not work unless teachers have prepared strategies and have pinpointed the instructional intent behind their group work (Allen 2012). It is also hard for one single teacher in a classroom to simultaneously be sure that interactions between students are productive amongst all the different groups (DeJarnette, Dao & Gonzalez). So yes, effective group work is easier said than done. If it does not work the first time, or even many times after that, keep trying because it is well worth it. Here are ways to try to make group work as effective as possible.

## **A Teacher's Role in Group Work**

What should teachers do to ensure that the group work occurring in their classroom is effective? As mentioned earlier, it has been found that a process help teacher intervention can be slightly more effective in mathematics classrooms. Process help interventions focus more on the

classroom norms dealing with interaction in group works rather than how the students are reasoning about the problem. In other words, with this type of intervention, teachers are not trying to improve the students' problem solving process, but rather their interaction process. The process help intervention is most successful when a teacher sets up the problem with the class as a whole before breaking up the students into their groups. It is important to make sure the students understand the context of the problem and what is expected of them (Dekker & Elshout-Mohr 2004). Setting expectations about student interactions can act as a road map for group conversations. However, these expectations are not meant to be strict rules but rather just a structure for their interaction so students know what is expected of them when working together in groups (DeJarnette, Dao & Gonzalez 2014). If the set up is done well, then teachers should not have to interfere much with the students as they work together in their groups (Dekker & Elshout-Mohr 2004).

Later on, I will discuss strategies that students can use to make group work effective. However, the majority of students will not be able to come up with and incorporate these strategies themselves. Therefore, it is the teacher's responsibility to model discussion strategies that students can use before, during and after students do their group work. Teachers can also make clear the good strategies already being used by pointing them out when they occur during group work. This helps students recognize when they ask good questions that will help make their group work and discussions effective. This is important for teachers to do since students may not realize they are doing so (DeJarnette, Dao & Gonzalez 2014).

It is important for teachers to know their students well enough to be sure that group work will be effective if used in their classrooms. In most cases, effective group work will be easiest to implement and more worthwhile with higher achieving students. Research has found that

when compared to lower achieving students, higher achieving students tend to have a better grasp of what characteristics are involved in making group work effective. They have a more complex understanding of what it takes to make group work cooperative, which makes group work more beneficial for them (Mulryan 1994). Therefore, if a teacher thinks it is possible that their students may not be mature enough to understand group work goals and expectations, it is the teacher's responsibility to realize if and how often group work should be implemented in their classroom.

### **A Student's Role in Group Work**

What should students do to ensure that the mathematics work they are doing together in their groups is effective? I believe that students have to be open minded to group work, especially if it is something they are not familiar with. Through practice of working with others on more complex or open ended tasks, they will hopefully develop into productive group members. There are also three strategies that students have been observed using to maintain productive mathematical discussions in their groups: asking questions about the problem, sharing the mathematical authority within the group, and challenging one another's mathematical ideas (DeJarnette, Dao, & Gonzalez 2014). It is also partly the teacher's responsibility to teach these strategies to their students so that the group will have these resources for working more effectively together.

Although it may seem that students will always ask each other questions about the problem when put into groups, this is not usually the case. If always exposed to a more traditional classroom setting, students are used to the teacher asking them questions and have not had the responsibility of questioning themselves. If students can learn to ask each other questions about the content of the problem or the process used for problem solving, this is one

strategy for effective group work. Doing so leads to dialogue and discussion amongst the members of the group and they will be able to see each other's understanding. It is key, however, to stress the importance that questions and discussions within a group should try to include everyone as evenly as possible in order to be effective (DeJarnette, Dao, & Gonzalez 2014).

A second possible strategy students can take part in to make group work productive is sharing the mathematical authority within their group. Sharing authority can be very challenging for groups because in doing so, students should take turns asking and answering questions and take turns presenting parts of the solution to the problem. More often than not, students are likely to accept that one or two group members have the authority. Usually these are the students that have found the answer to the problem or better understand the task (DeJarnette, Dao, & Gonzalez 2014). However, if the authority can be shared somewhat evenly, this allows for all the students to have an active role in the group and contribute toward the solution and mathematical understanding.

The last strategy students can use to try to make group work more effective is challenging each other's solutions and strategies. Students should push each other to explain or justify their solutions rather than just immediately accepting the ideas their group members are giving. This will challenge all the members of the group to develop a more sophisticated solution and make their mathematical argument more explicit. Like the previous strategy, challenging each other is not used as commonly amongst students as some other strategies are. Getting students to use this strategy though can make group work much more effective because it pushes students to develop better solutions and reasoning that benefits the entire group (DeJarnette, Dao, & Gonzalez 2014).

### **Tasks for Group Work**



What type of tasks are appropriate and promote effective group work? The best kind of tasks to implement in a mathematics classroom for group work are ones that generate good discussion amongst the group members. These types of problems should motivate and steer students to try to solve them with different strategies. They should also require students to justify their answers or solution methods so that it makes sense to them and their group members (Dekker & Elshout-Mohr 2004).

Tasks that involve manipulatives are usually the most preferred amongst students. When related to mathematics, manipulatives are any sort of object that can be used by students to better teach or reinforce a concept. Using manipulatives, such as flashcards, protractors, compasses, or blocks, is a great hands on way for students to learn. Teachers have also found that tasks using manipulatives worked the best in their studies because they resulted in good cooperative involvement from all students when working in their groups. Tasks involving manipulatives in most cases are more motivating and enjoyable for students because they are cooperative learning tasks when applied to group work situations (Mulryan 1994).

Choosing an appropriate task might be the most important component of ensuring that group work is effective. Tasks have the power to tell students what mathematics is and what is involved in doing mathematics. It is so important to choose a task carefully because it gives context to what students learn and think about the subject. They can also vary in the cognitive demand they place on students, so must be appropriate for a particular classroom (Henningsen & Stein 1997). A task must be able to fully engage students. They must be able to engage with the task and engage with each other while working the task.

## **Personal Experience**

As I mentioned earlier, group work was never something I did in a mathematics classroom until I started taking mathematics education classes here at Georgia. From what I have experienced working in groups myself, it can be very effective when implemented. From my own experience, it does seem that the claim I made above about group work being more effective with higher achieving students is true. I think it is safe to say that all my peers in my cohort are higher achieving students, especially in reference to the subject of mathematics. Most of our classes are heavily group work based and the tasks we are given are high cognitive demand. As higher achieving students, we have very productive mathematical discussions while working in groups on our tasks and we make each other accountable for understanding the concepts within the problem. The past two years during my cohort classes, I have been able to experience effective group work for myself as a student. I believe that this has given me a good idea of how my future students should feel while doing group work.

I cannot say that I have been able to observe much effective group work from a teacher viewpoint. The classroom that I am doing my practicum in at Oconee County High School this semester makes a weak attempt at implementing group work in the classroom. The majority of the class is teacher centered because the lesson each day is presented on the projector through slides that the teacher talks through in front of the class including both notes and practice problems. The students' desks are arranged in pairs to encourage them to work together when given the opportunity, which is usually just when practice problems are presented throughout the lesson or at the beginning and end of class with the warm up and any worksheet given to them. However, the group work is not set up to be effective. The tasks the students are given are simple procedural questions that do not involve any discussion points or differing solution methods. It is also easy to see that the classroom norms and expectations have not been set up to

promote effective group work because even though the students are in pairs, they rarely work together when given the opportunity and the teacher does not do anything to encourage them to work together. This class is also a support class, meaning these are lower achieving students, which is another factor as to why the group work in this classroom is not very effective.

### **Closing Remarks**

I would hope that now a days in high school classrooms, they are set up in a manner that promotes more group work in order to move away from traditional teacher centered lessons. Once I become a teacher, I do not want my classroom to be like the traditional classes I experienced as a high school student. Whenever possible, I want my students to be working together in groups and for the lesson to be less teacher centered. However, since I do not have much experience being a student in these types of classroom situations, doing research on this topic about what it meant for group work to be effective and how as a teacher, I can make this a reality in my classroom has been very helpful. My findings will be something I consider when planning lessons and choosing tasks in my future classroom.

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