

Keys to Successful Group Work: Culture, Structure, Nurture

The small-group approach changes the teacher's focus from being answer-oriented to being process-oriented.

—Weissglass (1990, p. 307)

WHY GROUP WORK? A BRIEF HISTORY

When I began teaching mathematics in the 1980s, few of my colleagues used group work, and those who did had minimal success. At the time, most high school classrooms were furnished with individual desks organized in rows, where students sat and listened—taking notes, practicing problems, seldom having the opportunity to collaborate with their peers—as students had for generations. Decades later, rows are still common but not nearly as pervasive. With the publication of NCTM's *Curriculum and Evaluation Standards for School Mathematics* (1989) and the focus on equity that followed, interest in cooperative learning grew, particularly with efforts to “de-track” mathematics in the high school. Educators recognized group work as an innovative practice with strong potential for meeting the learning needs of all students in heterogeneous classrooms.

Throughout the 1990s, other factors coincided to stimulate interest in group

work. Numerous researchers—from Cohen (1994) to the National Research Council (NRC 2000) added to the professional knowledge base supporting the use of learner-centered practices. Simultaneously, the National Science Foundation's investment in curriculum development yielded an array of research-based high school mathematics programs, such as the Interactive Mathematics Program (www.mathimp.org/) and Core Plus Mathematics (www.wmich.edu/cpmp/), encouraging small groups as an instructional strategy.

Across multiple decades and disciplines, research suggests that group work at the high school level affords particular learning benefits for students, mathematically as well as socially (Cohen 1994; Davidson 1990; Johnson and Johnson 1992; Willis 2010; Watanabe 2012). Mathematically speaking, students who experience well-implemented group work—

- have more opportunities to articulate their thinking;
- exhibit deeper understanding and retention of concepts;
- welcome the ideas of others and can incorporate them into their own strategies; and

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- feel less isolated and anxious about mathematics.

With respect to social outcomes, students learn to—

- communicate effectively, justifying their position through shared objective facts rather than emotional persuasion;
- work in a team environment, a skill increasingly needed in the workplace; and
- respect differences, particularly those relating to race and social position.

Despite the documented benefits of group work, a gap persists between research and practice. Too often, attempts to implement cooperative learning at the secondary school level do not reflect teachers' professional research-based knowledge. In my work with preservice teachers and their mentors, managing students in small groups remains one of the most common instructional challenges. I hear comments like these:

- “The students won’t take [group work] seriously.”
- “My strong students do all the work, and my weak students coast.”
- “I think it’s a great idea, but my students would rather work alone.”
- “I have too many students to do group work.”

Such comments reflect what research tells us: Successfully implementing group work does not happen without strategic preparation and instructional intent. Seating teenagers together in teams and giving them a common task may be a first step, but any positive results will be short-lived if teachers do not attend to critical details, particularly in the mathematics classroom.

Mathematics can serve as a uniquely valuable academic context for using group work. However, teachers also face mathematics-specific challenges with respect to issues of status. High school students have a strong sense of who does well in mathematics and who does not. These informal assessments of mathematics ability as well as perceived social

standing operate as sources of status in the classroom. If a teacher does not plan to mediate such inequities in the classroom, group work can exacerbate the issues that it could potentially alleviate, such as student motivation or differentiated learning outcomes.

Years of following the research and refining my own practice have confirmed for me three key elements of group work in high school mathematics. If all three are present and teachers experience the results, they will incorporate group work into their pedagogy

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from then on. However, if even one element is missing, success remains elusive. The three key elements are (1) a classroom culture that supports collaboration and teamwork; (2) structure for groups and tasks; and (3) strategies that nurture the work throughout the year.

CULTURE

What the Research Says

Students need trusting relationships with one another as a foundation for building small groups that can learn together (Middleton and Jansen 2011). As a result, teachers must create opportunities for students to become better acquainted with one another, investing heavily throughout the year in activities that break down social barriers and develop trust among students. Within groups, as students come to know one another better, the process will transform them from a group of individuals, focused on self-interest, into a team, committed to ensuring that each person succeeds (Glasser 1986; Webb 1985).

Studies have also shown that high school students working in groups who experience making decisions on their own rather than being told what to do express a greater sense of control over and responsibility for their own learn-

ing (Sharan and Sharan 1992). In addition, they tend to view their teacher as a learner as well—leading to a significant shift in the power dynamic that generally characterizes the secondary school mathematics classroom (Cohen 1994).

In My Experience

Teenagers need time to talk about mathematics and to justify their thinking. Cooperative groups afford such an opportunity. However, students will not feel safe sharing their ideas openly

in the mathematics classroom unless a supportive culture exists—one in which students and teachers exchange ideas, take risks, and are comfortable making mistakes. Such a classroom environment must be carefully crafted from the first day, and it begins with all students learning one another’s names—a simple step, too often overlooked.

Teachers also foster a supportive culture by encouraging each class to view itself as a community of learners with its own identity. This process will require that teachers cede some control to students. In such classrooms, students adopt an attitude of “sink or swim together.” As group members take more responsibility for one another’s learning as well as their own, they increasingly view mathematics as something that they can do—rather than something that is done *to* them.

STRUCTURE

What the Research Says

Regardless of the task, to ensure engagement and equity, teachers should define roles for group work and distribute them so as to mediate potential imbalances (Cohen 1994). Roles help ensure that students with lower status—as a result of social characteristics or prior

mathematics experience—will be given an important role in the collective work. They can also help temper the behavior of students who tend to dominate interactions or take over (Shulman, Lotan, and Whitcomb 1998). For example, a highly verbal student might be assigned a role that requires more active listening, while a student with less mathematical confidence might launch the task.

Over the years, four classic roles have surfaced in the literature. These are also the standard roles for teams described in the College Preparatory Mathematics curriculum (see www.cpm.org):

- *Facilitator*—Initiates activity and checks for understanding throughout
- *Resource manager*—Manages supplies and seeks teacher assistance as needed
- *Task manager*—Listens actively and keeps entire team on track
- *Recorder or reporter*—Shares data with all and seeks consensus before reporting

Assigning roles provides teachers with a powerful tool for mediating inequities and promoting more equal participation within a group. However,

students will still fail to collaborate if the task is not “group worthy,” meaning that it is better accomplished by a group than by an individual.

Watanabe (2012) suggests six features of group-worthy tasks: a focus on a big idea; access by multiple abilities; open-endedness; interdependence; individual accountability; and assessment. In mathematics especially, tasks that demand careful consideration and discussion because there is not an obvious solution or answer work best. The key is to offer students what Willis (2010) refers to as an “achievable challenge” for the entire group. When group work defaults to students working alone and checking answers, chances are that the task at hand is too simple to be an appropriate group task. Ideally, group-worthy tasks bring students closer together because they need one another to navigate the complexity of the task successfully.

Over the past thirty years, mathematics educators have articulated a range of strategies and structures for transforming individual tasks into group tasks (Andrini 1996; Erickson 1995; Kushnir 2001). One such method involves using a clue-based structure (Erickson 1995),

whereby each student takes responsibility for one clue, sharing the information orally. The group collectively makes sense of the clues to both define and solve the problem on a shared sheet of paper; see **figure 1** for an example.

In My Experience

Before assigning group roles, teachers will want to develop a vision for themselves of what group members will do in each role and clearly communicate these expectations to students. Whole-class discussions, including role playing, about what groups will look like if each person takes responsibility for his or her role in the collective work help ensure success. Classes that develop a strong sense of identity often create their own roles. Some examples that my classes have generated over the years follow:

- *Captain*—Ensures that everyone understands his or her role and participates
- *Timekeeper*—Tracks group work time and individual talk time
- *Skeptic*—Raises questions or doubts
- *Sound check*—Monitors volume level
- *Enforcer*—Keeps paper at the center of the table and keeps members in roles
- *Cheerleader*—Encourages positive attitude and persistence

Assigning roles fosters full participation in the group, but true cooperation necessitates engaging in a task that one person cannot readily accomplish alone. Problems of the Week (POWS), such as those appearing in the Interactive Mathematics Program (see www.mathimp.org/) or the Math Forum (see mathforum.org/pows/), are examples of readily available group-worthy tasks. Also, as a class develops into a community of learners, increasingly generating its own knowledge, students will begin to take interest in designing their own tasks. For teachers wanting to nudge their class in this direction, clue-based problems provide a simple format for students to initiate such work, often transforming a simple homework exercise into something much more engaging and complex.

Polygon 5 Your polygon has an area of 18 cm^2 .	Polygon 5 The longest segment that will fit inside your polygon is 6 cm long.
Polygon 5 Each side of your polygon has the same length. Each angle measure is the same too.	Polygon 5 Your polygon has a perimeter of about 17 cm.
Source: Erickson (1995, p. 127)	

Fig. 1 This example of a clue-based problem used for group work in a geometry class concerns polygons.

<p>Individual Exit Ticket Name: _____</p> <ol style="list-style-type: none"> 1. Reflecting on your group’s work today, write what you see as your group’s greatest accomplishment and greatest challenge. 2. To what extent do you feel satisfied with the role you played as an individual? What will you do the same or differently as your group continues to work together? <p><i>Note:</i> Your individual response is confidential. However, I will provide collective feedback to your group based on trends in all the exit tickets.</p>

Fig. 2 An exit ticket can help assess how effectively a group functions.

NURTURE

What the Research Says

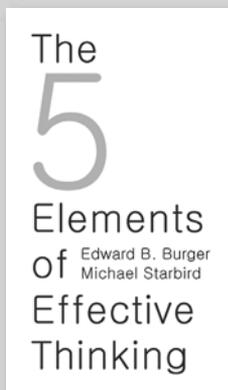
Even when teachers invest heavily in community building at the beginning of the year and organize well-designed group tasks in the months that follow, group work will deteriorate if teachers do not nurture the effort. Norms such as students relying on one another for answers to their questions, rather than turning immediately to the teacher as the source of knowledge, must be reinforced daily (Blumenfeld et al. 1996). In addition, teachers will want to invest in classroom activities that purposely attend to improvement, giving students opportunities to collectively debrief and evaluate their group experiences (Cohen 1994).

Throughout the year, small groups as well as the full class will benefit from team-building activities aimed at creating community. Varying tasks and activities, informed by regular student feedback, will also serve to keep group work fresh and exciting for students. To maintain motivation and interest, teachers need to make sure that students come to class curious about what the next hour will bring rather than readily able to predict what will transpire before the lesson has even begun (Willis 2010).

In My Experience

Classroom routines such as mathematics journals, exit tickets, and group quizzes can serve as powerful tools for nurturing the kind of individual responsibility and reflection that serve as the foundation for group work. Students can use their journals to write about their group experience, to test mathematical ideas before sharing them more broadly, and to communicate with the teacher about an issue that might be difficult to discuss face-to-face. Exit tickets—responses to short prompts completed on an index card or a half sheet of paper that check for understanding or poll for opinion—can be completed by individual students or by small groups. Group quizzes can focus on content or collaboration or both.

An example of an individual exit ticket aimed at assessing the effectiveness of the group is shown in **figure 2**. Ideally, students complete exit tickets



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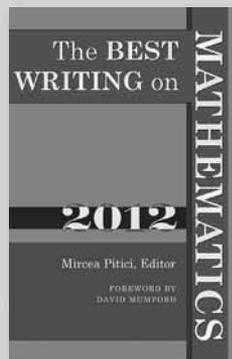
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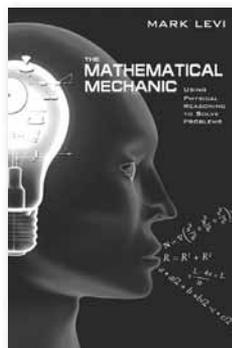
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during the last few minutes of class and hand them directly to the teacher, who stands at the door as students leave the classroom.

When seeking to invest in the class as a whole, teachers may find that structured group activities that remix the students into new small groups for a short time or that encourage pairwise interaction help infuse new energy into the community-building process. Two strategies that I have found particularly useful are matching and lining up (Kushnir 2001). Matching activities involve individual cards (such as clue-based problem solving). However, in this case, the teacher predesigns groupings of two, three, or four cards that share a common theme or concept. In an algebra class, an activity could involve cards that display an equation, a table, a graph, or a verbal description. The teacher distributes a card to each student, and then students move about the room in search of the others whose cards “match” theirs. Once students have a match, the group sits down and justifies its decision on paper, demonstrating how each card is a different representation of the same relationship.

Similarly, lining-up activities provide an opportunity for pairwise, whole-class engagement. Again, each student receives a card. This time, however, the cards might have an expression to evaluate or an equation to solve. Each student works individually to obtain a result and then uses this value to determine his or her place in a numerical line-up of the class. Once they have taken a place in line, students verify their results with a neighbor and then make corrections and reshuffle as necessary. Once the class believes that it has an accurate line-up, the teacher walks down the line, calling on a few students to confirm that they are in the right order, or simply collects the cards in order, confirming as she or he goes.

GROUP WORK IS WORTH THE EFFORT

For a high school mathematics teacher, perhaps nothing is more satisfying than a classroom full of students who want to be there and who come to class ready to engage in compelling work.

Well-implemented group work serves as a cornerstone of such a community of learners. When students learn to see each person in the classroom as an important resource, everyone benefits. High-achieving students learn to place less value on quickly finding the correct answers, whereas struggling students experience less isolation and gain more confidence. All students have the opportunity to expand their own thinking by embracing ideas and strategies beyond their own.

To teachers who have struggled with group work in the past: I urge you try again. If you have never tried, begin. Your students will thank you and then astound you with what they can do. Your teaching will never be the same.

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