

#### Discussion Techniques

The Mathematics Section (Curriculum Research & Development Group, University of Hawaii) focused on developing discussion techniques that could be used in lessons to promote student engagement. These techniques include— 1) collaborative groups; 2) cooperative groups; 3) carousel or gallery walk; 4) poster sessions; 5) expert groups; and 6) sharing groups.

These instructional techniques were developed to vary the routines in the mathematics classes. The names of the methods are introduced to students to help them establish routines around each of the different types.

#### Cooperative Groups

Cooperative groups are distinguishable from collaborative groups in that the former are primarily focused on product and the latter on process. Cooperative group activities are often used as an introduction to a new topic with such resources as *Get It Together* or *United We Solve*. Additionally, cooperative groups can be effective with project-type tasks that may culminate a learning trajectory.

#### Cooperative groups provide:

- Accountability as students are assigned jobs or roles in the group
- Strong student-to-student interaction
- Tighter management or classroom/group control by the teacher
- Access to self- and peer-evaluation

#### Collaborative Groups

Collaborative groups are the basis for our mathematics classes. They are part of the original instructional format that was developed in the Mathematics Section in CHED. Their creation was prompted by the need to have more student engagement in the discussion and to involve multiple students.

In collaborative groups, the teacher either assigns a problem or allows students to select a problem or which each group will be responsible. At the beginning of class, once the selection of problems is completed, the teacher asks students to move into groups to discuss the problem assigned to them. Time for discussion is structured so that no more 7-8 minutes is allowed at this point. The responsibility of the group is to produce a presentation sheet and a means by which to discuss the problem, including all points, questions for the class, and multiple solutions or solution methods. Students are then randomly selected (or, on occasion, groups may be allowed to select their presenter) to do the presentation before the whole class. The teacher's role at this point is to raise extension questions and to help regulate the discussion with the presenting group.

#### Collaborative groups offer:

- An easy check of student understanding by the teacher
- A method to discuss multiple solutions or solution methods
- Opportunities for groups to select a problem that plays to their strength or that supports their comfort level
- A high level of student-to-student interaction
- Accountability within the group in terms of selecting a random presenter
- Leadership development of students

#### Sharing Groups

Learning groups are a hybrid of collaborative groups and thus beneficial to use in the middle of a learning trajectory. Their use is a variation that allows students to conduct more peer-type evaluations.

The primary difference between sharing and collaborative groups is that in sharing groups, students do not present the problem for which they wrote the presentation sheet. Instead, at the end of the time for preparing the sheet, the teacher collects the presentation sheets and redistributes them to another group. The groups are then given an additional five minutes to review the presentation sheet and decide if they agree with the solution and the solution method; 2) have questions about the problem; and 3) offer other appropriate solutions or solution methods. Discussion is then conducted similarly to that of collaborative groups.

Learning groups allow students to:

- Analyze other students' work, considering solution techniques and thinking
- Create multiple methods and solutions
- Focus on key or critical problems for discussions
- Interact between and among students at a high level

#### **Poster sessions/modified poster sessions**

Poster sessions are done toward the end of a learning trajectory, when students are beginning to get on their feet between and among concepts and skills. An advantage of poster sessions is that they promote high engagement as students must focus on the work and their own homework papers in a time-selective environment.

Poster sessions are structured so that each group of four students is given (or self-selects) a problem from the homework problem set. Each group receives a sheet of poster paper and a broad-tipped marker. Groups are told by the teacher to write their problem number, their group names, and a description of the problem solution on the chart paper. The time allotted for this is approximately 8 minutes. At the end of eight minutes, the posters are rotated through all the groups. (For modified poster sessions, posters may not go through all groups but only through a portion of them.) As a group receives a new poster, they are to: 1) agree with the solution and/or solution method; 2) ask a question; 3) answer a question previously posted; 4) supply another method or solution; and 5) offer recommendations to the originating group. When the poster returns to the original group, that group is to summarize questions and comments and check the mathematics in the problem. Some groups may be called upon to summarize their problem with all of the comments. In the modified poster session, all groups report out.

Poster sessions are useful to:

- Promote high student engagement
- Focus on a variety of students' methods and perspectives
- Promote students' discussion on their own misunderstandings or misconceptions within their groups

#### **Carousel or Gallery Walk**

The Carousel method is very similar to the Poster Session. The same materials are used with the addition of each individual student receiving small post-it notes (the number of notes is equal to the number of posters created, minus one). The advantage of the Carousel is that students have more of an individual investment in the analysis of and response to each problem. This technique is often used for later problem sets in a learning trajectory.

The set-up for Carousel is the same as the Poster Session, except that when groups record their solution, they use only the left half of the poster paper. The right half is left blank for student feedback. After the problems are recorded on the poster papers, the papers are posted around the room, allowing enough space for students to move in a group through all of the posters. Students begin with their original problem and then move in carousel fashion to the next poster where they are given 2-4 minutes to analyze the solution and method and write a comment to the group on their own post-it note. Students write their name and group number on the note. These notes are then put on the right side of the poster. When the original group returns to its problem, they remove the poster and return to their table. The post-it notes are then taken off the poster sheet and can be categorized by those that 1) agree, 2) disagree, 3) ask specific questions, and 4) are not appropriate. The group then works on clarifying and responding to the comments. Groups are selected for whole class presentations.

Carousel/gallery walk gives students the chance to:

- Receive and give individual feedback—each student has a voice in the process
- Move around
- Have public accountability by responding to a problem and having it open to all others to read
- Summarize comments in a more structured and organized fashion
- Interact between and among students at a high level
- Balance group and individual work

#### **Expert Groups**

Expert Groups allow students the opportunity to develop confidence in a specific problem(s). They force students to contribute to a group setting and place a high degree of accountability and responsibility on students. Expert Groups are most often used with problem sets that are in the mid-point of the learning activity.

Problems from the homework problem set are divided into four clusters by either random assignment or deliberate relationships. Students in the groups of four number off 1, 2, 3, and 4. All of the 1's are given their problem assignment, 2's are given theirs, and so on. Students are then reconfigured into new groups so that all of the 1's are together, 2's are together and so on. A group facilitator is either assigned or selected within each of these larger groups. They are given approximately 15 minutes to discuss their problem assignment. They must take notes on their problem and gain consensus on a correct answer or answer. At the end of time, all students return to their original groups. The group leader is responsible for facilitating the discussion so that each student in the group reports out on their problem.

To others in the group take notes, ask questions and make corrections on their homework. If there is an agreement on the solution or method or a question that the "expert" cannot answer, the group leader raises those questions down and they are discussed during the debriefing stage. During debriefing, the teacher may select specific problems to discuss by having groups present to the whole class or the teacher may ask extension or probing questions.

Expert Groups can accommodate:

- A small number of problems on a homework problem set
- Heavy student-to-student interaction
- A high degree of student responsibility and commitment to the group
- Motivating students to contribute to the discuss
- An inter-student reliance