Assessment

Our students learn what we value primarily by observing what we assess. In the CPM Connections courses, we value a broad range of skills and abilities. It is therefore crucially important that we use a broad range of assessment strategies.

What do we value?

In a CPM Connections course, we value,

- **Mathematical Understanding:** Understanding is a prerequisite to remembering, connecting and using mathematics.
- **Skill Proficiency:** Skills are necessary to succeed at the mathematical tasks that students will encounter in these courses and beyond.
- **Problem Solving:** Our students need to learn to use what they know and think logically about problems to devise effective strategies to find solutions.
- **Communication:** Our students need to be able to use mathematical language and talk and write about their ideas effectively.
- **Justification:** Our students should be able to give logical arguments to defend their reasoning both orally and in writing.
- **Mastery Over Time:** We expect our students to continue to build broader and deeper understanding of the ideas in each course as the year progresses.
- **Multiple Ways of Seeing:** We value breadth of thinking. Our students should seek, find, hear and understand multiple ways to think about a given mathematical task.
- **Cooperative Learning:** In order to achieve many of the above-mentioned goals, our students need to work together. They need practice talking about mathematics and building deeper understanding by listening to the reasoning of other students. Therefore, it is essential that we place high value on students learning to work cooperatively.

How can we assess what we value?

To incorporate a broad range of values, we need a broad range of assessment tools. The following tools are described in this section.

- **Individual Tests** allow us to determine our students' ability to demonstrate mathematical skill and understanding in writing.
- **Team Tests** are great opportunities for students to assess themselves and for teachers to assess the use of mathematical language, cooperation, problem solving, justification and multiple ways of seeing and representing.

- **Participation Quizzes** allow teachers to assess (and therefore support) the quality of the teams' cooperation, independent of mathematical content.
- **Student Presentations** allow students to exchange insights, use the language of mathematics, and deepen their understanding at the same time that it allows teachers to assess mathematical communication, justification and making connections.
- **Class Observations** allow teachers to assess (with varying degrees of formality) the quality of the discussion of mathematics in the interactions created as teams work together.
- **Portfolios** can be used as self-assessments as well as vehicles for parents and teachers to assess students' understanding and growth.

Individual Tests

Testing students individually on their ability to solve mathematical problems, on their level of skill mastery and on their conceptual understanding of topics or ideas is an important part of a comprehensive assessment plan.

When should I give Individual Tests?

Individual chapter tests can be given after a chapter is completed. If you intend to include new ideas from the entire chapter, consider waiting to give the test a few days (or even a week) into the next chapter. Some teachers prefer to give individual tests that are cumulative and come at regular intervals (such as every two or three weeks), regardless of where they are in the course.

What should be on Individual Tests?

Remember that anything called "test" communicates to students what content is important and what level of mastery is expected. Some ideas to consider as you choose topics and problems to put on individual tests:

- Mastery takes time. Ask yourself, "What do I expect students to have mastered **at this point**? Which topics are so new that it might be best to save them for the next test or assess them in some other way?" There is clear potential to set your students up for failure (and demoralize them) by giving them the perception that you expect mastery of an idea that they are still coming to understand. Pushing for mastery too soon may also lead students to memorize procedures (often incorrectly) without conceptual understanding.

- We recommend that each individual test be constructed of roughly 35% current material and 65% older material. Many teachers are accustomed to giving a chapter test that has some basic, intermediate, and challenging problems on the content that has just been taught. But the 35% new / 65% spiraled structure allows you to test for **basic** understanding of new but not yet mastered topics. You can also ask increasingly challenging questions about earlier ideas **after** students have had weeks, not days, to work with them. This structure also allows you to use problems that require multiple ideas in their solutions, once again emphasizing the connectedness of mathematics.
- It is neither necessary nor desirable to test every concept the students have seen on every test.
- Do not let it get too long. Try taking the test and timing yourself. It will generally take your students five to seven times longer than you to complete the test. Remember that the more graphing is involved, the longer the test will take.
- The purpose of an individual test is to find out what your students know. Problems should be accessible through thinking and reasoning, not just solvable by one clever move. Students should feel challenged, yet teachers should be sensitive to what is realistic for their students. Again, give them opportunities to show what they know, rather than displaying the fact that you can write lots of hard problems.

CPM has provided a test bank organized by chapter. It includes problems that can be used on team or individual tests, as well as a sample team test and a sample individual test for each chapter.

How should I grade Individual Tests? Should I Use Points or Rubrics?

There are several different approaches to grading tests, and clearly teachers (or departments or districts) must develop methods with which they feel comfortable. Whatever the approach, emphasis should be placed on the mathematical thinking evident in the work. Credit should be given for ideas, attempts and partial work as well as for correct answers. Students should be given the message that their mathematical thinking and understanding is valued, even if they have made errors.

Rubrics

Rubrics are scoring guides that allow teachers to grade student work holistically, focusing on reasoning and process, as well as answers. Rubric grading replaces the traditional "points" system of grading, in which partial credit is doled along some predetermined distribution of points. With rubric grading, teachers read the entire solution and then decide on the level of mastery or understanding shown. They then assign one score to the entire solution, guided by the rubric.

For most test items, a 4-point rubric is sufficient, although some teachers use 5 or 6-point rubrics. Rubrics can be very general, or can be tailored to fit the problem or task that is being assessed. Some sample rubrics are included at the end of this guide.

When using rubrics to grade individual tests, each problem is given a score. Then the scores are either totaled or averaged to yield the overall score on the test. Be careful, though, not to simply translate these results to traditional percentage grades and to assign grades according. In a 4-point rubric, for example, a score of 2 does not correlate to 50% (and therefore an F) in a traditional grading system. At the end of this guide, there are some suggestions for translating from rubric scores to percent based grades.

Revisions

One benefit of rubric scoring is that the students gets clear feedback about how close they came to meeting the teacher's expectations, without being told exactly what they did wrong, forcing them to analyze their own work more closely. Feedback can consist of questions and suggestions instead of corrections or mere notations of errors. Many teachers take this opportunity to allow (or require) students to turn in revisions.

Rather than going over a test as a whole class, some teachers pair students and then give them class time to work on discussing mistakes and revising their work. This encourages students to revisit the mathematics of the problems themselves, rather than being told how they should have approached the problems. Some teachers count the revisions as an assignment separate from the test, while others convert the revisions into added credit for the test itself.

Some teachers require students not only to revise their incorrect solutions, but also to analyze the errors in their thinking or computations by answering a series of questions. Some examples are:

- Why did you miss the problem? (Careless error, did not know how to do it, guessed, used the wrong formula, tried a strategy inappropriate for the problem, etc.)
- What did you learn from revising the problem?
- Who (if anyone) helped you and what did they say to help you better understand the problem? Please be specific.
- Make up a new, similar problem. Show and explain to a new student (in writing) how to solve the problem. Be sure to justify your steps.

Team Tests

To build a class culture in which teamwork is truly essential for learning, it is important to assess teamwork as well as individual assignments. Team Tests show students what is valued and give teachers another opportunity to support and assess students' teamwork.

What is a Team Test?

A Team Test is an assessment in which collaboration is essential for mathematical success.

Why should I use a Team Test?

A team test provides opportunities for certain kinds of learning and collaboration:

- The perceived high-stakes environment inspires students to work together effectively. Teachers note that even teams that do not often collaborate well come together on a Team Test. Somehow the "test" label raises the students' perception of the importance of doing well on the task. Therefore, students are more likely to ask each other for ideas, explain their thinking and help each other identify errors than during regular class time.
- A well-constructed Team Test allows teachers to assess not only mathematical knowledge, but also the abilities of teams to think creatively or broadly, to justify their reasoning and to solve problems that require synthesis of knowledge.
- The quality of discussion inspired by Team Tests makes them a useful way for students to gauge their own level of learning (including their readiness for an individual test).
- Team tests are fun! Students should know that on team test days, everyone is going to learn something and have a chance to be successful.

How do I know what to put on a Team Test?

Team Test problems should be designed to inspire in-depth conversations and collaboration around essential mathematics.

- ***Problems should inspire collaboration.*** They should be challenging enough that all students will recognize the need to talk and work together, but not so challenging that students will give up. Problems can assess larger ideas, higher order thinking skills and more than one concept or topic in a single problem. They can require significant reading, interpretation, decision-making, and justification.

- ***Do not make it too long!*** A typical Team Test should be no more than two to four rich and interesting problems. If it is too long, students will feel that it is more important to complete the test than to discuss, ask questions, or offer assistance.

- Questions that focus on one skill (such as solving equations or graphing a parabola) can still be appropriate for a Team Test if students are in the process of building understanding about a skill or procedure. For problems like these, it might be especially useful to have four different forms of the test, so that students can discuss *how* and *why* to do the problem instead of what answers they got.

How should I grade a Team Test?

A team test should be graded primarily on mathematical content. There are several options for grading a team test:

- ***Teacher observation*** (circulating and listening) is an important tool for assessing the quality of both mathematics and teamwork. You may choose to intervene if many teams are stuck on the same question, or if you notice a student being left out or hindering a team's progress. Based on your observations, you can determine whether to take individual students' performance into consideration when you grade the test.

- ***Randomly choose one paper*** from the team to read; if the work on all of the papers is roughly the same, then everyone in the team gets the same grade. Encourage students to make sure they agree with what their teammates are putting on paper (but without simply copying). Some teachers quickly check all of the papers in the team. If there is significant variance, they grade each paper, thus allowing all students to receive credit for their own work. This prevents complaints about giving students less credit than they perceive they deserve, but it can also undermine the cooperative element of the team test.

- ***Grade one problem on each team member's paper***; everyone in the team gets the same grade for each problem. This prevents one student from receiving blame or getting all the credit for a team's score. It also allows the teacher to gauge the extent to which the team worked together. This also promotes good discussion as it makes clear the expectation that all team members are responsible to contribute to solutions. While students may disagree on strategies and solutions, they should engage in sufficient discussion to ensure that each student has a clear and mathematically justified response. Use the same caution here about wide variations in student work explained in the previous paragraph.

- If you notice one member of the team not collaborating, you can make a note and score that student individually. If the rest of the team has made a sincere effort to include that student, be careful not to downgrade them for the reluctance or refusal of one or two students to make a serious effort on the test. Please refer to the Participation Quiz section of this guide for suggestions about engaging all team members in team discussions.

- Most teachers weight Team Tests significantly less than individual tests. Some teachers give them about a third to a half of the weight of individual tests. Others weight them as 10 – 20% of an individual test grade. Others average all of the team tests for a semester and count that score as one individual test grade. (If your grading policy drops the lowest test score of the semester, there will be no room for criticizing the use of team tests in grading.) Some teachers increase the weight of team tests as the year progresses and students become better at collaboration.

What do I say to students and parents who have concerns about a low Team Test grade?

First and foremost, team tests should be opportunities for all students to do well. Managed properly, they should usually earn high marks for most students. If there are low scores, review the content of the tests. We want to challenge our students, but we also want them to have opportunities to show what they can do.

At the same time, students' ability to talk and work well together affects their learning, so it is appropriate that teamwork be one aspect of class assessment. Since Team Tests are weighted far less than students' individual work, one low Team Test score should not affect a student's course grade. However, if low Team Test scores are common for a student, then you may need to diagnose the reason and meet with the student individually, as this problem could be reflected in the student's grade. It may be prudent to point out that successful teamwork is essential in a student's ability to build the communication and justification skills necessary for success academically and otherwise.

What can I do if teams don't work well together on a Team Test?

Most important, consider *why* teams are not talking or working well; this will help you determine whether and how to intervene, and what changes might be useful in the next days' lessons.

It may be that the test itself is not well constructed. Perhaps the questions are not really worthy of teams' collaboration, or they are so hard or ambiguous that students are frustrated. Perhaps the test is too long, and so students feel like they do not have time to talk in depth. Perhaps students' teamwork has not been supported sufficiently on a daily basis so they are not sure how to work well together. There is, of course, also the possibility that some students are not doing the work necessary for the course, which should correlate with their other assessments.

Here are some ideas teachers use to inspire good teamwork on tests:

- As part of the introduction to the Team Test, inform students that the complexity, difficulty, and/or ambiguity of the test questions will require them to talk and work together well to be successful. Explain to students how you intend to grade their work, so that they know the extent to which everyone's papers will factor into the Team Test grade.

- Give only one or two copies of the test to each team, so teammates have to share. This is a reminder that the test is not individual work. Each student then completes the test on their own piece of paper; you will collect all four papers.

- Some teachers carry a clipboard as they circulate to make note of good discussions, good teamwork, and students who are not contributing. After the test, teachers report to the class some of the positive observations that they made.

- Circulate through the classroom as teams are working on their tests and offer support. Since a team test is largely a self-assessment and an opportunity for learning, it is appropriate for teachers to support teams as they struggle. Students should quickly learn that the teacher does not give them answers, but that teacher responses to well-chosen questions can help them on their way. Most students should find success on team tests.

Participation Quizzes

We know that students do not just work well together automatically. Teachers who are clear about the value of study teams for student learning nevertheless often report struggles such as these:

> *"How do you get students to work well in study teams? My students seem to just talk about hair care and sports unless I'm standing right there."*
>
> *"My students are just rushing through the problems without looking for deep understanding."*
>
> *"Whenever my students hit a tough problem, they just give up and sit there."*
>
> *"My students are really reluctant to work together, so I end up running all over the classroom answering individual questions."*

Teaching students to work effectively in study teams must be done explicitly and routinely. Even in classes that function well, teamwork can periodically break down. And, when a particular lesson is especially challenging, students may not realize that their best teamwork skills are required for success. To help with these struggles, teachers developed a structure known as a *Participation Quiz*.

What is a Participation Quiz?

In a Team Test, good teamwork is essential for success, but students are assessed mostly or solely on the quality of their mathematics. In a Participation Quiz, the **quality of the teamwork** on any given task is documented and assessed directly by the teacher, rather than the mathematical content. As students work together, the teacher watches and listens, recording observations on a transparency or board. Below is an example of what this record might look like:

TEAM 1	TEAM 2
• *Quick start! Facilitator reading immediately.* • *"Does everyone understand the question?"* • *Great team question* • *"What if we…"* • *Explaining in the middle of the table – all 4 leaning in to see and discuss.* • *"I think the graph is saying that ___ because ___..."* • *"Wait, explain that again."* • *All four sticking together: "Are we all ready for the next question?"*	• *All four reading quietly – Make sure you discuss!* • *Talking outside group – Task Manager please do your job!* • *Making statements but without reasons – Tell WHY!* • *All four working but in pairs – be sure everyone understands and agrees.* • *One person blasting ahead*

As you can see from the sample notes, a Participation Quiz documents the language, behavior, and even body language teams use as they work on a task. For classes implementing team roles (Facilitator, Task Manager, Recorder Reporter, and Resource Manager), it documents successful use of these roles. This documentation gives teams real-time feedback on the teacher's expectations and how teams are doing. (For more information on Team Roles, please refer to the "Study Teams" section of this Teacher Edition.)

When should I use a Participation Quiz?

There are at least three scenarios in which teachers have found a Participation Quiz to be useful:

- ***At the start of a course, to begin teaching students about high-quality teamwork.*** Some teachers use a Participation Quiz on the very first day of class to set the tone. In the first week of a course, it is helpful to spotlight one or two key teamwork behaviors to emphasize in a Participation Quiz (such as students not talking outside the team, or Resource Managers calling the teacher over only for team questions), along with the kinds of talk that we might expect to hear from a team that is doing this well. The teacher might say, *"Today's problem is interesting and challenging, like many of the lessons we will work with in this class. If you were working on this problem alone, you might think it is too hard. Luckily, you have your teammates to share ideas with. I want to give you credit for doing a great job of working together, so today's problem is going to be a Participation Quiz. I am going to record what I see and hear that I think will help you and your team to be successful. In particular, I want to make sure that, Resource Managers, you only call me over for questions that your entire team has discussed fully already. I also want to see that no one talks outside their team – if someone slips, I need to hear the Task Managers doing their job."*

- ***During the course, at times when the class seems to need a vivid reminder of what great teamwork looks, sounds, and feels like*** – a reminder of just how much students can learn from talking and working *very well* together. Sometimes, for example, a class might be slow to get started working. Announcing a Participation Quiz in which the teacher will focus on getting off to a quick start is one way to help students tune up their teamwork. For example, the teacher might say, *"I've noticed that teams have been struggling to get going lately, and this slow start has meant that your conversations have not been as useful or focused as I think they need to be for you all to learn the mathematics deeply. So let's make today's lesson a Participation Quiz. I will be watching and listening for two things: Facilitators, I want you to make sure that tables are clear except for all the materials your team will need, and that you are all reading today's problem together. Also, Task Managers, I need to hear you challenging your teammates to give reasons for their ideas."*

- ***For a lesson that is mathematically complex enough that students' best teamwork skills are essential for success.*** Many lessons within CPM Connections have significant opportunities for depth if students strive for connections, justification, and multiple representations. Simply stating this at the beginning of the class may not be enough to help teams recognize how important it is that they push for depth. But, by structuring the lesson as a Participation Quiz, the teacher can help students remember what it will take to be fully successful. For example, the teacher might introduce a lesson by saying, *"Today's lesson is very challenging – it has a lot of complex mathematics that will help you make sense of the big ideas of this chapters. You will need your very best teamwork skills to make sense of all the math you need to learn, so today's lesson will be a Participation Quiz. I want to hear two things: I will be listening for teams that give reasons for the ideas they discover, and I will be looking for teams that make sense of their ideas."*

How do I know what to record on a Participation Quiz transparency?

The purpose of Participation Quiz notes is to give students feedback about how well they are working together in a manner that supports their learning. In general, the more specific the feedback is, the better students are able to use it as a guide. Direct quotes are especially valuable, as are specific behaviors that you expect to observe. Simply writing "*Great teamwork!*" or "*Excellent facilitation!*" does not help students (especially those in other teams) realize what specific behaviors are valuable.

Because space is usually limited, it is helpful to develop some shorthand (such as RM for Resource Manager or TOT for talking outside the team) and to only record some portions of direct quotes ("*What if we…*" or "*I think it's … because …*").

Depending on class size, some teachers remain at the overhead, taking notes as they observe teams from there. Others circulate and listen, taking notes on a clipboard. Either way, it is important that observation notes remain as visible to students as possible.

Some teachers prefer to record only positive feedback, others record positive and negative (perhaps using different colors), and some use a "strengths and questions" format. You are encouraged to find the format that works best for your students.

It is common for students to "overact" at first, deliberately saying and doing things that they think the teacher wants to hear. This is not necessarily a bad thing, particularly if the team responds to the overacting with the kind of teamwork desired. Over time, this tendency will diminish.

Finally, it is very important to leave enough time to debrief the Participation Quiz notes with the class. It is useful if the notes about each team help the teacher tell a story – tell why the team was successful (or not).

How do I evaluate Participation Quizzes?

In general, your evaluation of a Participation Quiz should be based on the quality of teams' interactions. It is often helpful to write a previously agreed upon symbol (for example an up or down arrow) for each team in the middle of a Participation Quiz, so that students can see how they are doing.

One way to factor the mathematics into a Participation Quiz evaluation is to require teams to call the teacher over at strategic points to explain or justify an answer. Typically, the teacher will choose one team member at random to explain on behalf of the entire team, then evaluate the entire team based on that member's ability to explain and answer follow up questions.

Participation Quizzes do not need to be factored into a student's grade. Teachers should use them to help facilitate the learning process for the class as a whole and for individual students.

During Participation Quizzes you could make brief notes about what individual students do in their teams and their strengths and weaknesses as learners. These notes about individual students should be kept separate from those that the students see. You could then use this information, especially as patterns emerge over time, to help students become better learners. It can also be powerful information during parent conferences to give insights into students as developing learners that goes beyond their knowledge of the course content.

How do I get started? How might I use a Participation Quiz within Chapter One?

Möbius Strips (Lesson 1.1.2) provides a good opportunity for a first Participation Quiz, since this activity requires substantial discussion, decision-making, and team questions if any teams get stuck. The team roles are useful in helping students structure their teamwork, so one purpose for a Participation Quiz during this lesson would be to begin teaching how to perform the roles. Beginning with a quiz helps set a tone for the class that is focused on talking and working together for the sake of learning. For this reason, trying to keep the feedback positive is critical and will be most productive. Also, using the word "quiz" for something besides a written problem draws attention to the role and importance of communication and discussion in mathematical activities.

The Family Fortune (Lesson 1.1.4), while not typical, involves lots of reading and interpretation. Because this problem introduces the thread of logical reasoning in this course, teams may want to allow some team members to dominate the conversation or quickly settle on the idea of another team member without deep thinking and consideration. As a Participation Quiz, it would be useful to help instill the importance of all team members participating in a mathematical "argument," which will help them begin a path of logical conclusion based on evidence. In addition, expect the team to ensure that everyone understands what the question is asking, as well as recognize the value of giving both statements and reasons.

During Building a Kaleidoscope (Lesson 1.1.5), a Participation Quiz might help alert students to the importance of deep discussions and excellent team questions. If you have an individual hinged mirror for each student, a Participation Quiz on this day could teams prevent students from working individually (since it is challenging to see the reflections that another student sees). This will require the Facilitators to make sure they are asking, "*Does everyone agree?*" before moving on to a new question.

Student Presentations

Because much learning takes place as students exchange ideas and teach each other, CPM Connections courses emphasize multiple ways of seeing important mathematics as well as the connections among those ways of seeing.

For students, presentations;

- ➤ offer the opportunity to learn by listening to someone other than the teacher;
- ➤ convey the idea that students are responsible for their own learning
- ➤ require whole class support as each team enters its "trial by fire;" and,
- ➤ allow students to exchange insights and thus deepen their understanding.

It is important that team presentations include meaningful mathematical contributions by all team members. Strategies for supporting this are included below.

What opportunities are in Connections for student presentations?

- ***Closure presentations:*** One team is responsible each day for bringing closure (by summarizing or otherwise) to the main idea or skill that was learned or practiced in the day's lesson. The teacher provides the team with presentation materials (overheads, pens, charts, etc.) at the beginning of the period so students can prepare their presentation as they work on the lesson. Rotate the responsibility for closure presentations through all of the teams.

- ***Poster or transparency presentations:*** Connections occasionally asks students to summarize or synthesize their learning on a poster or overhead transparency. If all teams' results are likely to be similar, presentations could be tedious and uninformative. In these cases, the poster should "*stand alone;"* it should show and explain teams' thinking fully without the need for verbal explanation. However, when teams' results show different ways of thinking, presentations are useful.

- ***Individual presentations:*** Often, as students work on rich problems, some will use unique processes, organize their thinking differently, or discover new ideas. If time permits, it is valuable to ask these students to present their ideas. This not only teaches the rest of the class new mathematical thinking, but also reinforces how important it is to be able to see mathematics in multiple ways, and that different students have different strengths.

- ***Homework:*** Some teachers find time in class to process homework, but prefer not to go over homework themselves, instead relying on student volunteers to present their thinking. Others assign the responsibility to present homework solutions to a different pair or team of students every day. Even if students were not able to complete the problem, it can be valuable to have them lead the class discussion necessary to find a solution.

How can I ensure that all students present?

Because the Connections series rely so much on communication, it is important that all students become willing and proficient presenters, both individually and in teams. Although some students are very shy and fearful of speaking in front of the class, it would be doing these students a disservice if they were excused completely from ever presenting. Students are willing to present for various reasons: to earn points, to please the teacher or to indulge their love for the limelight. Ultimately, however, getting all students to present frequently and productively depends on students recognizing that, by presenting, they will learn the material better and will feel smarter.

A few suggestions follow.

- All students should be engaged in talking and sharing ideas with their teams. If you have extremely shy students, work with them to become comfortable sharing ideas with their teammates, then transition to perhaps a specific role in a team presentation.
- Many teachers rely exclusively on volunteers to present at first, using these early presentations to build safety, trust, and other expectations, especially acceptance and safety, for presentations (both for the presenter and the audience).
- Students may be more willing to participate, especially early in the year, if each member of the team does one part of or plays one role in the presentation.
- When going over problems, some teachers specifically ask for a volunteer who is not sure how to do the problem and wants to learn, to instill the norm that it is safe to present even when a problem is still in the process of being solved (which could otherwise cause some students discomfort.)

Regardless of whether a student has volunteered to present or was required to, all presentations should be acknowledged with positive feedback, especially praise for the mathematics and reasoning. Even when a solution or explanation is flawed, presenters should not sit down feeling embarrassed or incompetent. Genuine positives need to be acknowledged in each presentation (even if accompanied by suggestions for correction and improvement), otherwise students will begin to think that they will only look bad by presenting in front of their peers, and will subsequently stop volunteering.

One word of caution: Be careful about forcing reluctant students to do presentations. Some of them may have learning disabilities or personality issues that make doing so difficult. Be sensitive and gentle.

How can I ensure that all team members participate in team presentations?

One way to make sure all team members participate is to assign the responsibility for this to the Recorder/Reporter. Recorder/Reporters should ensure that all team members know what they are presenting and in what order. It is important to clarify that participation in a presentation means explaining significant mathematics as well as being able to respond to questions about any aspect of the presentation.

Presentations will be of better quality if students know ahead of time how the teacher will assess them. One way to communicate your expectations is to have a Recorder/Reporter "huddle" (where all Recorder/reporters meet in a region of the classroom and huddle with you to hear a common message). This allows you to state, "*Make sure that your poster includes… "* once instead of multiple times.

It is also powerful for the teacher to give immediate feedback on what was effective about each presentation. Scoring presentations with significant weight can also ensure that students take them seriously. Teachers often ask students in the audience to fill out a feedback form for each team presentation. This reminds audience members that they are responsible for being active listeners, and also helps presenters know more about what is expected in their presentations. (Some sample feedback forms are included on pages 25 and 26 of this section.)

Class Observations

As we build a comprehensive plan for assessment, it is important to recall *why* we assess our students. Of course, it is usually our responsibility to assign grades. But the most important purpose of assessment is to learn about our students: what they know, how they think, how they work together, what questions they have, how they overcome difficulties, etc. One of the best ways that we can do this is by listening to and watching students as they learn. Observation has not generally been part of formal assessment, but it should be. Structures such as a Participation Quiz can be used to name, discuss and quantify observed behaviors that contribute to learning. For students whose strengths are more auditory and oral, observation and assessment of their communication while they are working in teams can give you another avenue to determine their understanding. It can also be used as an additional component of their grade.

Monitoring mathematics and planning accordingly

Circulating and listening to teams' discussions allows teachers to learn about students' mathematical progress and to make appropriate instructional decisions: What are students learning as they discuss the day's tasks? Are they all getting stuck on the same thing? Is my planned homework assignment still appropriate? What further learning might I spark or what specific aspect of the lesson should I address to open class tomorrow? Should I adjust the closure I had planned?

Monitoring and influencing status

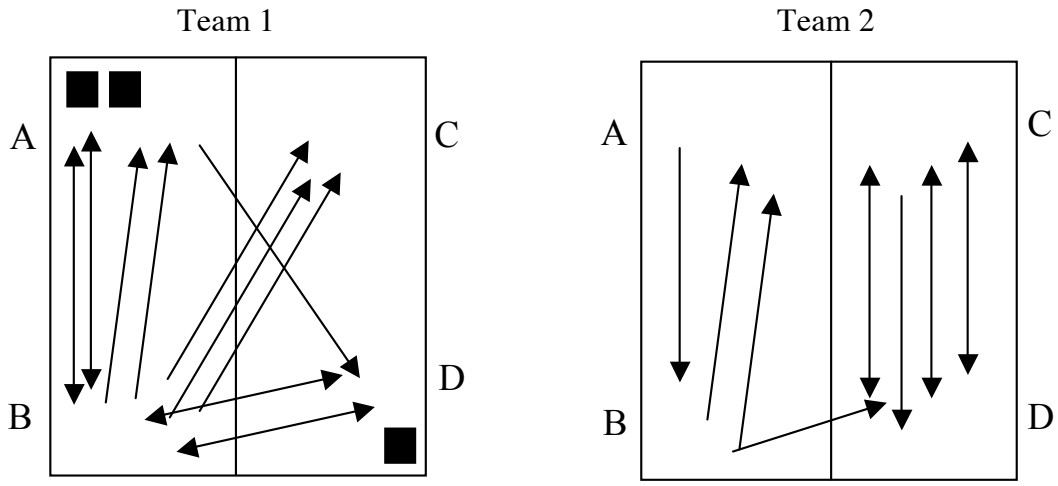
In any class, students tend to assign different status (prestige, merit, worth) to all participants – both socially and intellectually. High-status students typically participate more, while low-status students may tend to hide and be ignored. Teachers have the power to influence perceptions of status by catching low-status students saying or doing mathematically intelligent things, and pointing out this intelligence in a way that is public, and specific. For example, a teacher could say, *"Sammy, I noticed that you used color to show corresponding sides and angles in the two triangles and then you used these colors to create a proportional equation. Finding and showing connections like you did is one of the most important math ideas in this chapter! Can you show your team how you decided what to color so they can find their own connections?"*

High-status students also benefit from positive feedback as well as suggestions about what they should be working on next – especially if it is something they might learn from someone else in their team. Since the Connections courses stress justification, connections, and multiple ways of seeing and doing, teachers will find many opportunities to shape what it means to be "smart" in math beyond just getting the right answer as quickly as possible.

Monitoring and influencing interactions and participation

Even in well-functioning teams, participation among all members can be uneven. In response to this, teachers have developed a strategy called the *Interaction Diagram*, which allows them to document and illustrate participation patterns for students. These diagrams can be done in real-time, visible to students (like a Participation Quiz) or more privately as a personal tool for the teacher, not necessarily shared with students. If shared, just seeing a visual of how students are (or are not) interacting can be motivation enough for teams to improve the quality and frequency of their interactions.

An Interaction Diagram uses a seating chart to note particular kinds of interactions among teammates. Here is a sample:



The arrows represent instances in which the teacher observed team members talking. A one-way arrow represents a student speaking to a teammate (e.g., to explain an idea or share an observation). A two-way arrow represents an interaction that appears to be an exchange of ideas or a statement followed by a question or other response. The shaded squares indicate an interaction among the entire team.

Based on Interaction Diagrams such as these, teachers can consider a variety of questions and interventions:

- In team 1, it appears that Student B is working hard to interact with all members of the team. Is Student B a good facilitator, a domineering student, or something else? Students A and D seem to be interacting with others as well, but neither spoke to Student C, who seemed to be completely silent. What might explain these patterns of interaction? How typical are they? What might help Student C be more active in participating? Would showing the team this Interaction Diagram help Student C be more vocal, or would it be embarrassing? Maybe it would be enough just to show the Interaction Diagram to Student C privately?

- Team 2 appears to be working almost exclusively in pairs. All four students seem to be participating, but is pair work an effective or appropriate strategy for this team? For this lesson? What might account for this tendency? Would it help to ask two of the students to switch seats? If so, which two students? Would it help to show this team the Interaction Diagram for Team 1? Is this interaction pattern acceptable for this lesson?

Note that you may make Interaction Diagrams for the teams for several days to look for patterns in their behavior. For example, Student C in Team 1 above may normally participate, but did not do so in this lesson or for the time you made your observations. Team 2 may interact very well, but the task observed in the lesson shown above was best suited to working in partners, not in a team of four.

Portfolios

Many people have some idea of how portfolios are used by professionals. Artists' portfolios display their best work, showing the scope of their talent and skill. It is essential in their efforts to find work and recognition. Fashion designers, photographers, models and architects also use portfolios. A math portfolio is not much different.

What is a math Portfolio?

A math student's portfolio is a collection of work showing the scope of the student's understanding and skills. Students may naturally want to display only their best work, but their portfolios should also show growth over time. Teachers and parents find this tool useful in assessing students' understanding and growth.

What are Portfolios used for?

Use of portfolios can:

- Help students assess their own math learning.
- Help teachers assess understanding and make instructional decisions accordingly, without the pressure of a test.
- Prompt students to consult new people and sources, engaging in a meaningful learning dialogue.
- Include photos, videos, drawings and other modes of presentation – allowing students to be creative.
- Serve as wonderful vehicles to communicate with parents and the community.
- Help educators outside of the classroom assess the math learning in a class.
- Give students a chance to "show off" their learning, taking pride in their own perseverance, growth over time, and appropriate use of math tools, techniques and proficiency.
- Give parents and community members a chance to appreciate students' work when showcased at a Portfolio Night.
- Be passed on to the next math teacher (when possible), giving the next teacher important information and allowing the students to monitor their own learning over a longer period of time.

What can a Portfolio contain?

Portfolios are often kept in folders and stored in the classroom, although they can also be kept in folded construction paper, in a binder or electronically. Many teachers provide some kind of cover sheet or entry slip (often copied onto colored paper) to accompany each portfolio item. A portfolio can be used as:

- ***A collection of self-evaluation and reflective assignments.*** The students document their learning about a particular topic, or a part of a chapter, quarter or semester. They discuss problems they had, issues that have not yet been solved, parts of the learning they most enjoyed, as well as their understanding of the mathematics itself.

- ***A collection of well-written solutions to rich problems.*** The students write up thorough solutions to selected problems. This type of portfolio assignment may also require students to reflect on their own learning process, including and discussing first attempts and early incorrect solutions.

- ***A collection of student work.*** The students (and/or the teacher) select problems and assignments to be assembled into a folder with a theme such as, "Here is what I know." This allows students to "show off" their learning to their families and peers.

What makes an assignment or activity "Portfolio worthy"?

Portfolio entries should showcase students' understanding, learning, development, mastery of a mathematical idea or group of ideas and/or struggles they have overcome in the process of learning. Activities from each Chapter Closure (concept maps, graphic organizers, concept or chapter summaries, responses to the "How Am I Thinking" prompts) make natural portfolio entries.

The Connections courses are rich in problems and activities that allow students to make purposeful selections of items to include in a Portfolio. For each item, they could be asked to justify their choices and their value using an "Entry Slip." An example is included at the end of this guide. Students might be asked to select items in response to prompts such as these:

This assignment shows:

- ➤ *How well I can work with my team to solve a challenging problem.*
- ➤ *Something new I learned that was hard at first.*
- ➤ *Something I still have questions about.*
- ➤ *A math idea I taught to someone else, and they got it.*
- ➤ *A math idea someone else explained to me, and I got it.*
- ➤ *How well I can do a homework assignment.*
- ➤ *How well I can justify my ideas.*
- ➤ *How well I can explain my thinking in writing.*

It is important to expect students to give detailed accounts of the reasons for each choice they make. For example, they could use an explanation such as:

"This assignment shows a math idea someone else explained to me and I got it. At first I did not understand how to find the perimeter of a shape, but then Marisol showed me how she labeled her diagram, and then checked my work when I tried to use her idea. She showed me how to count the edges around the outside of the shape and that sometimes you have to compare the lengths of opposite sides to find the length of parts. She also answered my questions very patiently."

How do I determine Portfolio grades?

Some ideas for grading Portfolios are:

- Use a rubric. This has the benefit of being holistic and efficient – you can very quickly quantify the degree to which the student has met your expectations.
- Do not give the Portfolio a grade or score, but add your own comments. This allows students the chance to get feedback without the intimidation of a letter grade. Many teachers prefer to add their comments on post-it notes to avoid writing directly on student work.

- Give only A's or B's on Portfolio assignments. You can return entries that do not earn one of these grades for revision, thus emphasizing your high expectations.
- Involve parents in the learning of their child by sending the Portfolio home (along with a rubric) and asking the parent(s) to evaluate it. You could include a prompt on the evaluation form that asking them to articulate what they learned about their child's understanding.

How do I get started? What could I put in a Portfolio from Chapter One?

We recommend that you wait at least until your second year in a new curriculum to implement the use of Portfolios in your classroom. Learning a new curriculum can be time consuming enough without adding such a large new assessment structure.

Chapter 1 of Geometry Connections has a number of activities that could be used as Portfolio entries. A few ideas:

- Möbius Strips (Lesson 1.1.2): Students could use this problem to showcase their beginning teamwork and problem solving. A thorough write-up could be used to display the process of investigation. This problem could also display students' beginning level of understanding of conjecturing and asking mathematical questions.

- Carpetmart (Lesson 1.1.3): This problem provides an excellent opportunity for students to display the algebra skills that they have retained from a previous course.

- The Shape Factory (Lesson 1.2.4): Students could display their beginning level of rotation and reflection with this problem. They also can document their currently knowledge of vocabulary (by naming the shapes created by reflection and rotation).

- Any homework assignment: Students can use early homework assignments as the beginning of a growth over time sequence, displaying their continually growing ability to explain their thinking clearly and solve a wide variety of problems.

4 Point Rubric

4

You get it.
I can understand your thinking clearly.

3

You mostly get it.
I can understand most of your thinking.

2

You sort of get it.
I can understand some of your thinking.

1

You get a little bit of it.
I can see some thinking.

0

You don't get it.
I can't understand your thinking.

4 Point Rubric

For Scoring a Single Problem or Task

4 Fully Accomplishes the Purpose of the Task

- Student work shows full grasp and use of the central mathematical idea(s).
- Recorded work communicates thinking clearly using some combination of written, symbolic, or visual means.

3 Substantially Accomplishes the Purpose of the Task

- Student work shows essential grasp of the central mathematical idea(s)
- Recorded work in large part communicates the thinking.

2 Partially Accomplishes the Purpose of the Task

- Student work shows partial but limited grasp of the central mathematical idea(s).
- Recorded work may be incomplete, somewhat misdirected, or not clearly presented.

1 Makes Little or No Progress Toward Accomplishing the Task

- Shows little or no grasp of the central mathematical idea(s).
- Recorded work is barely (if at all) comprehensible.

0 Makes No Effort

Six-Point Rubric

6 Excellent Understanding (A+)

- Student work shows excellent understanding of mathematical concepts, principles, and their inter-relationships.
- Performance shows mastery of the use of mathematics to solve problems.
- Data analyses and explanations demonstrate a high level of reasoning.
- Models, principles, or theories are used creatively to analyze problems, draw analogies, and make insightful inferences and appropriate applications to daily life.

5 Strong Understanding (A)

- Student work shows strong understanding of mathematical concepts, principles and their inter-relationships.
- Performance shows very good understanding of the use of mathematics to solve problems.
- Data analyses and explanations demonstrate a high level of reasoning.
- Models, principles, or theories are used effectively to analyze problems, draw analogies, and make inferences and applications to daily life.

4 Good Understanding (B)

- Student work shows good understanding of mathematical concepts, principles and their inter-relationships.
- Performance shows good understanding of the use of mathematics to solve problems.
- Data analyses and explanations demonstrate sound reasoning.
- Models, principles, or theories are used correctly to analyze problems and draw analogies.

3 Basic Understanding (C)

- Student work shows basic understanding of mathematical concepts, principles and their inter-relationships.
- Performance shows some use of methods of mathematics to solve problems.
- Work states facts, draws conclusions, or makes assertions that are incompletely substantiated.

2 Limited Knowledge (D)

- Student work shows limited knowledge of mathematical concepts, principles and their inter-relationships.
- Performance shows limited use of mathematics to solve problems.
- Some mathematics may be correctly demonstrated, but evidence of an understanding of broad concepts is lacking.

1 Minimal Knowledge (F)

- Student work shows minimal knowledge of mathematical concepts and does not provide evidence of an understanding of individual facts, concepts, or their interrelationships.
- Performance shows little or no correct use of mathematics to solve problems.

Translating Rubric Scores to Grades

As a rule, rubric scores do not translate directly into percentages, but as a practical matter they often need to be translated. As with the four-point rubric given early, do not translate a score of 2 to 50%, and then consider that to be failure. According to the description, the student who receives a score of 2 clearly has some knowledge. Similarly a 3 on a 4-point rubric is not equivalent to 75%. It is more likely B level work. A few possible translations follow:

The four-point rubric translated into grades.

Score	Option 1	Option 2	Option 3	Letter Grade
4	100%	93%	3.5 - 4.0	A
3	85%	82%	2.8 - 3.4	B
2	70%	70%	2.0 - 2.8	C
1	55%	50%	1.0 - 1.9	D

The six-point rubric translated into grades.

Score	% option	Letter Grade	Description
6	97-105	A+	Excellent Work
5	90-96	A	Great Work
4	80-89	B	Good Effort
3	70-79	C	Adequate
2	55-69	D	Inadequate
1	40-54	D-/F	Unacceptable
0	0-39	F	Nothing of Value

PRESENTATION FEEDBACK

TEAM PRESENTING: YOUR NAME:

HOW WELL DID ALL TEAM MEMBERS…

Present meaningful mathematics?	4	3	2	1
Answer questions?	4	3	2	1
Know when it was their turn to speak?	4	3	2	1
Present to the entire class (not just looking at the teacher)?	4	3	2	1
Speak loudly and clearly?	4	3	2	1
Other criteria:	4	3	2	1

DURING THE PRESENTATION, HOW WELL DID *YOU* …

Listen attentively and respectfully?	4	3	2	1
Understand the math that the team was explaining?	4	3	2	1
Ask questions?	4	3	2	1
Other criteria:	4	3	2	1

WHAT IS ONE THING YOU ESPECIALLY LIKED ABOUT THIS PRESENTATION?

PRESENTATION EVALUATION

Team Presenting: **Your Name:**

Criteria	**Points**	**Comments**
Well organized:	__ out of 4	_____
Presented math ideas, work, conclusions clearly:	__ out of 8	_____
Justified conclusions:	__ out of 4	_____
Well presented:	__ out of 4	_____
TOTAL	___ out of 20	

How CLEAR was the presentation?

5 The presentation was easy to follow and easy to understand.

4 I got confused once or twice while listening to your presentation, but overall it was easy to follow and easy to understand.

3 I got confused several times while listening to your presentation.

2 You got confused several times while making your presentation.

1 You had an idea to start with but most of the rest of your presentation did not make sense or follow up on that idea.

How INTERESTING was the presentation?

3 The presentation was interesting because it was well-organized, creative and included useful visual aides.

2 The presentation was somewhat interesting, but needed more organization and creativity.

1 Oral presentation rambled and lacked clear focus.

Any comments?

Assessing the Performance of the Audience

Attendance and Respectfulness During Presentations.

5 Student was in attendance, on time, paid attention, contributed to several discussions when appropriate and was respectful for every presentation.

4 Student was late for day of presentations but paid attention, contributed to a discussion when appropriate, and was respectful to those (s)he heard.

3 Student mostly paid attention and was respectful to all presenters.

2 Student did not pay attention to a presentation or was disrespectful during a presentation.

1 Student did not pay attention to several presentations or was disrespectful during several oral presentations.

Portfolio Entry Slip

Name _____ Date _____

Description or Title of this Assignment: _____

How much time did you spend on this assignment? _____

Where did you work on this assignment?

❒ Mostly in school ❒ Mostly at home ❒ In school and at home

Did anyone help you on this assignment? ❒ Yes ❒ No

If yes, who helped you and how did he or she help you? _____

_____

_____

_____

Why did you choose to include this assignment? _____

_____

_____

What are you most proud of about this assignment? _____

_____

_____

_____

_____

_____

Does this assignment show growth in your learning? ❒ Yes ❒ No

If yes, describe how this assignment shows growth. _____

_____

_____

_____

_____

_____

What do you still hope to learn about the mathematics in this assignment? _____

_____

_____

_____

_____

_____