

## Math: Data Practices

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Review foundational knowledge about [Data Practices](#) in K-12 Blended Teaching (Volume 1).



### 8.1 Collecting Data in Math Courses

#### Teachers Talk: Data Provides Real, Actionable Information About Student Learning (3:58)

Reflection Questions: How are you already collecting data in your own classroom? Do you have access to any tools or programs that allow you to determine which students may need some intervention?

Data can inform all parts of your teaching. It can help students see their own progress and areas that need improvement. It can help you understand what specific students need. It can provide information students can use in setting and evaluating goals. Technology has greatly expanded the way data can be recorded, collected, organized, and used in a timely and efficient way. Teachers can easily and quickly collect technology, and the data can be used to enhance their pedagogy, group students, plan remedial and extended activities for students who need them, and target specific needs of individuals, groups, and the whole class.

## Teachers Talk: Various Ways to Collect Data



### Sandy Chalke

I usually do a small station rotation.... Some kids will probably read a book, some kids will work on a worksheet, some kids will go online and do the interactive activity, some kids will sit with me and make sure that they understand the day's learning goals. So basically that's my check. Are you understanding the concept? Do you have any questions? Can I help you?

## Teachers Talk: Choosing What Data to Collect



### Rachel Peterson

I think one of the things I really have liked is being very strategic on what I want a record of and what I want automatic data from— not just so that I know who did it and who didn't do it, but so that I can see exactly what students are thinking. When you're in class and you're walking around seeing who gets what, you can kind of gather some information that way. I like having it housed somewhere, where I can go back to it and provide individual feedback.

In order for data to be helpful, you have to organize it in a meaningful way. You may want to use subjective and objective data, observations, performance criteria, and areas of a rubric aligned with a certain learning objective. Here are a few examples:

**Table 1**

*Collecting Data—Some Ideas*

Desired Data	Ways to Gather the Data Using Technology
Students' personal characteristics	These data often come from teacher-made resources and surveys that help you get to know your students. You might use a Google Form to have students answer questions about their learning preferences (such as working alone, in groups, by reading, by watching, or by writing), their best times of day for studying, their hobbies, their interests, their perceptions of their strengths and

Desired Data	Ways to Gather the Data Using Technology
	weakness in math, what they want from your class, what they are nervous about in the class, the types of assessments and activities they prefer, etc. This data can also consist of socio-emotional data gathered from check-ins, student surveys, or platforms like Rhithm that can track a student's mood, how much sleep they typically get at night, or when they last ate a full meal. It can be important to notice and take notes of students' participation, interest in various topics, friends, attention, outside interests, interaction with others, clues about home life, etc.
Mastery data	This data may be in your learning management system (LMS) or an outside mastery tracker that you create. It often includes data from activities and assessments. This data can usually be collected from the results and analytics of students' quizzes, assignments, or tests which reflect their understanding of certain concepts, definitions, formulas, their understanding of proofs and theorems, their computing skills, or their ability to apply the algorithms and proofs that they have learned to solve real-world problems. This data can also come from state-mandated tests. Collecting and then analyzing mastery data can help you know what most students have mastered, where students need remediation, and where learning materials may need to be improved. You can then work on changing instruction guided by the data you have collected and analyzed. Training in using the grade book, quiz statistics, mastery trackers, or other performance trackers may be necessary to gather mastery data.
Activity Data	You can obtain activity data from your LMS by running analytic reports. The reports may include students' time spent reviewing LMS pages or modules, participating in activities or assignments, who submitted assignments on time, who was late or absent, who missed assignments, etc. This data can also be obtained from observations of students' learning habits and behaviors, like staying on-task or not appearing challenged and engaged. Collecting and analyzing activity data can complement mastery data. Looking at activity data and mastery data together can help you understand the academic stories of individual students. For example, you may notice from mastery data that a student's academic performance has dropped abnormally, and upon checking his/her activity data, see if the decrease is due to less time spent on reviewing learning materials or not submitting assignments.
Goals and progress towards goals	You can keep track of goals and the progress students are making in a spreadsheet or goal sheet you create. You may choose to create SMART goal trackers that students keep in a data binder where they set and track their goals, growth, and challenges.
21st-century skills	You can collect data on how well students are developing the ability to collaborate through students' self-reflections on the process of collaboration and their contributions, participation in a discussion board, ability to work with students on a shared document, and reports from the students' peers. You can also track this data through class observations.
Help-seeking strategies	Observe how your students seek help and record what you see: Do individual students seek help online, from other students, or from you? Are they afraid to ask for help? Do they seek help when they might figure it out on their own?



### **Blended Teaching Workbook**

In your blended teaching workbook, you have a blank table like the one above. Decide what sources of data you would like to use in your classroom. Fill out the chart based on what data you want to collect. You may have to ask others for ideas on types of technology and what you need to learn to use the technology.



## 8.2 Utilizing Data in Math Courses

Tracking data can help Math teachers improve student learning and their own teaching. Because data can help you know your students' skill levels in a large number of math objectives, it can help you in creating curriculum, differentiating and personalizing activities and assessments, helping students set goals, and tracking progress. It can also help you see strengths and weaknesses in your curriculum and approach to teaching, allowing you to improve your teaching. As you look at the example below, notice how the teacher uses data. Think of ways you could improve your class by collecting and analyzing data.

### Teachers Talk: The Importance of Offering Feedback (2:55)

Reflection Questions: How does this teacher give feedback in an online setting? Do you think that the methods she uses are also relevant in a traditional classroom?

In analyzing data, it is important to look for trends that may occur at the individual, group, or class level. Each of these different scopes may provide a different understanding of the data. For example, if you teach algebra at three different times during the day and the second and third classes did well on an assignment but the first class did not, then you know there was likely some misunderstanding in the way the first class processed the information. Likewise, you may look at activity data for student progress in group labs and find that some groups are moving slower than other groups. This may allow you to provide slower groups with more time or support so they don't lag too far behind your other classes, or recognize which groups do not work well together due to getting distracted. At an individual level, you may recognize that some students seem to understand the class content really well when discussing it with you, but less well when they take a test. This pattern could be evidence of test anxiety or that the student was having an "off day." That student may also need more support before they can work accurately on their own. Various data types can help you to understand what contributed to a student's "off day."

Triangulating the kinds of data you track for students (such as performance data, activity data, and learner profile data) and the scope of that data (individual, group, or class data) can reveal different patterns and trends that help shape various facets of your instruction.

## 8.2.1 Mastery levels in a Math class

### Teachers Talk: Mastery Data and Remediation



Rachel Peterson

We use a standards-based grading system in my math department. It's super clear and easy. I can see what standards students have and have not mastered. We are constantly looking at who has passed this essential and who hasn't yet and then adjusting in class instruction or doing some targeted interventions depending on how many students need intervention.

Because the math curriculum requires students to think critically and solve complex problems, it can sometimes be difficult to measure mastery. How do you decide when a student's understanding of a math word problem meets the requirements for mastery of critical thinking and analysis skills? Likewise, how do you determine where a student's mastery lies in a multi-step process where any number of errors could occur.

This is where both data practices and personalization can help. A close analysis of such things as student work, written and verbal explanations of math concepts, the ability to explain their reasoning, etc. can help you find strengths and weaknesses in your students' mathematical and analytical skills. For example, one person may be strong at solving for a missing variable in an algebraic equation but weak at explaining how this concept is useful in an authentic scenario. Another may be strong at organizing data but is weaker in representing the data visually. Maybe the student needs to improve in understanding about what a word problem is asking as opposed to completing the necessary mathematical expression represented by the word problem. Maybe the student needs help using math language properly or using inquiry to solve a problem. Using this type of information to help students set measurable goals and create mastery paths can help both you and the student decide what mastery looks like and how to best measure mastery for each individual student.

It may be that some students have similar problems and can be grouped together to learn from each other and offer each other support. Students who excel can become mentors for those who need help and in turn can have students who are strong in areas in which they are weak become mentors for them. Determining what students have mastered and what needs additional reinforcement is an important place to start. In the video below, you can see some ways to determine the needs of your students.

## Teachers Talk: Many Ways of Using Data (4:39)

Reflection Questions: How does the tool this teacher uses check for student mastery? What is she able to do with this data once she collects it?

### 8.2.2 Using data to help improve pedagogy

#### Teachers Talk: Data Practices—Remediation



**Mikki Stuart**

I've been able to get a better handle on where students are academically by using technology and really utilizing digital reports. I can see when a student misses several questions in a row and they're just not getting it. I know who to reach out to. I know how to help them. In a quick conference, we can identify the error and they're able to move forward.

Because data often come from student performance and student activity, if you pay careful attention to student data, you can learn a lot about how to best teach your students and what pedagogy to use. What activities lead to the best results for what kinds of learning outcomes? What confuses your students? When are they most engaged? Does their engagement also lead to understanding and mastering learning outcomes? Reflecting on questions like these can help you evaluate yourself as a teacher and your students as learners. They can lead to insights that can strengthen your pedagogy and help students achieve mastery as well as their goals.

## Ideas: Using Quiz Data

Quizzes (and other assessments) are a common source of data. Here are some ideas for using quiz data to improve your teaching and student learning:

1. Check to see if your LMS lets you align questions to specific learning outcomes. If it does, you can determine which outcomes students need more help with.
2. If many students miss the question, check to see if there is a problem with the question (miskeyed, difficult wording, unclear answers or expectations). If there are no problems with the question, check the standard to which the question is aligned. Pinpoint specific areas of confusion, analyze your instruction, and modify where needed.
3. If most students answer correctly, check to see if the question is too easy. If it isn't, review your teaching strategies for strengths that you might be able to use for similar learning objectives.
4. If just a few students miss the question, you may want to pull those students out in a small group and reteach specific principles, offer resources for remediation, or provide them with extra practice.

Teachers use data in all sorts of ways. Here are some examples of ways teachers have used data in a math classroom. What ideas do their experiences give you?

### Example 1: Using Data to Help Students Get Services

Consider two students with opposite needs in a geometry course. Through the use of data collection from tests and formative assessments done with programs like EdPuzzle and Nearpod during class, the teacher can assess their needs and determine how to best help them.

- With one student, the data showed overwhelmingly that the student was not understanding the basic concepts or terminology regarding parallelograms. The teacher could provide remediation in this area using tools and programs geared toward struggling students.
- Another student was getting bored in the class. He was finishing all assessments quickly and earning high scores on all of them. The student could be given extension activities to allow him to do more inquiry activities that would hold his interest and allow him to stay engaged in the course.

### Example 2: Using Data to Determine How to Make Questions Better

Sometimes what we intend to measure on an assessment is not what we are, in fact, measuring. It is important for you to analyze data from assessments not only to determine what your students know but to ascertain how well your assessments are actually measuring the intended learning objectives. For example, if a multiple-choice question on a test has a misleading choice as one of the wrong answers, it is possible that students are getting that question incorrect because of the way it is written rather than because of their own misconceptions in the math content. In order to best measure our students learning, teachers have to make sure they are actually asking the right questions. Analyzing assessment data frequently not only allows teachers to determine more about their students' learning but also evaluate the quality of their teaching and assessments.

### Example 3: Using Data to Answer Questions

Using data you can to ask and find possible answers to a lot of different questions:

- Q: Why did every single student miss this question?
- A: The question included a drop-down menu. The students didn't know how to use it.

- Q: Why did this class understand a concept and another class didn't?
- A: We didn't have time for the online activity in one class. When the teacher went back and did it in the other class, their scores improved.
- Q: The data shows that my morning class struggles to understand core concepts. Why?
- A: You may have to experiment to find the answer to this one. You may realize that these students needed to have some physical movement that early in the morning, even if it wasn't education-related movement. Afternoon classes, however, could be tired from the day and just want to listen and work quietly. You may have to adapt your approach for both classes.

#### Example 4: Using Data to Group Students

### Teachers Talk: Grouping Students Based on Data



#### Mikki Stuart

As I regularly look at the quiz and test results, I rearrange the seating chart several times so that I have a couple of strong and a couple of weak students at the table together to support each other.

Most learning management systems will allow you to sort students by their scores on assessments. This data could be used to group students. For example, sometimes you may want to group a high-scoring student and a low-scoring student to allow for some peer tutoring. Other times, you may want to group a handful of students from the bottom together to work on some targeted remediation with you while the rest of the class moves on to something else. This data can also be used to group students for projects and inquiry-based activities.



#### Blended Teaching Workbook

Think of one source of data that you are not using but that you could use in your classroom. In your workbook, outline a way to collect that data and ways you can use it.

If you haven't already opened and saved your workbook, you can access it [here](#).



## Teachers Talk: Data Practices to Inform Future Instruction



**Mikki Stuart**

We use our reports to see how students are doing with a concept. It will guide where we go the next day. What still needs to be reviewed? What's good? Can we move on? I love that I can see which questions most kids are getting right and wrong. It helps me adjust and see that maybe some content needs to be taught better.

Collecting and using data may feel uncomfortable. You may think you can't do it. But if you think about it, you are collecting data all the time. You are watching your students, evaluating practice problems, interacting with them, listening to them. You are ready to take the next step and find more formal ways to include data in your understanding of your students, their learning patterns and needs, and your strengths and weaknesses as a teacher. Data collection can open new ways of seeing.

### Previous Citation(s)

Keaton, W., Short, C. R., Guo, Q., & Jensen, M. A. (2022). Math: Data Practices. In C. R. Graham, J. Borup, M. A. Jensen, K. T. Arnesen, & C. R. Short (Eds.), *K-12 Blended Teaching (Vol 2): A Guide to Practice Within the Disciplines*, Vol. 2. EdTech Books. <https://edtechbooks.org/-FTPZ>



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