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Teaching Tutorial 5: Progress Monitoring in Reading Using the CBM Maze Procedure



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1. What is Curriculum-Based Measurement in Reading using a Maze Procedure?

Curriculum-based measurement (CBM) is a continuous progress monitoring system that you can use in basic skill areas like reading, written expression, spelling, and mathematics. Specifically, CBM in reading using a Maze procedure is a system used to monitor overall reading proficiency that can be simultaneously administered to individuals, small groups, or classrooms of students.

CBM Maze is useful for monitoring individual students or groups of students in either general or special education classrooms. The scores derived from each CBM data collection session serve as overall indicators of how students are performing in reading. Data from CBM measures are analogous to degrees on a thermometer when taking someone's temperature. A temperature is an indicator of a person's overall health. If a person's temperature is above what is expected, she may need to make changes to improve her health. CBM is used to monitor a student's educational health. If the CBM data are below what is expected, a teacher may need to make changes to improve a student's educational performance.

To use CBM Maze, a teacher first alters several text passages of a similar reading level by deleting words throughout the passages and offering three word choices for every word that is deleted. The teacher then collects baseline data using these passages (also known as Maze probes) to see how the students are currently performing. Utilizing this baseline data, the teacher sets individual long-range goals for each student and continues to monitor student progress by frequently administering probes throughout instruction. The teacher graphs the results of each probe and compares these results to the long-range goal set for each student. If students are making progress towards their long-range goals, the teacher continues his/her current instruction. If students are not making progress towards their long-range goals, the teacher makes instructional changes in an attempt to increase student progress.



For a maze probe, each student receives a copy of a text passage with several words deleted. For each deleted word, the student must choose the correct word from 3 choices.

CBM in reading using Maze is useful to teachers because:

1. CBM Maze is **easy to learn and implement**.
2. CBM Maze is **inexpensive and time efficient**. CBM uses materials already found in most classrooms. Further, collecting and graphing CBM data takes less than 20 minutes per week (depending on the size of the class being monitored.)
3. CBM Maze is **standardized**. Administration of the Maze probes remains consistent each time the teacher tests the student.
4. CBM Maze measures are **reliable and valid**. The measures are reliable because the probes measure similar skills over time. The measures are valid because they have been well researched.
5. CBM Maze measures are **sensitive to growth**. Small gains in performance can be seen on the graph on a daily and weekly basis.
6. CBM Maze data are **collected frequently and used formatively**. The measures allow the teacher to respond quickly to lags in student performance.

2. How do we know that CBM Maze is effective?

A large body of research supports the effectiveness of using CBM to monitor student performance in reading. A significant portion of the research completed on CBM is related to measures of oral reading. However, Maze has also been researched as a measure of overall reading proficiency and can serve as a good predictor of student performance, particularly for middle and high school students (Espin, Wallace, Lembke, & Campbell, 2004). CBM Maze measures are highly related to students' performance on other standardized reading measures, like reading achievement scores on the California Achievement Tests (Shin, Deno, & Espin, 2000), the Gates-McGinitie Reading Tests (Jenkins & Jewell, 1993), and the Metropolitan Achievement Tests (Jenkins & Jewell, 1993), but have been shown to be more sensitive to small changes in student growth than traditional standardized tests. Maze is also related to teachers' judgments of students' reading ability (Jenkins & Jewell, 1993).

Some teachers view Maze as a practical measure of reading performance because it can be administered in a group setting and students can work on the task independently. Teachers may also use CBM Maze as a measure of reading performance in lieu of oral reading fluency because they feel that Maze is a better task to use with students who have comprehension difficulties.

By using CBM Maze within a progress monitoring system, a teacher can adjust his/her instruction more quickly to better meet the needs of an individual student than if the teacher relied on summative standardized tests. Further, the students of teachers who use CBM to monitor reading performance perform better than students whose teachers do not use CBM (Stecker & Fuchs, 2000). Table 1 describes selected studies of CBM Maze.

Table 1: Selected studies of CBM Maze

STUDY	SUBJECTS (GENDER, AGE, GRADE LEVEL, DISABILITY)	FINDINGS
Parker, R., Hasbrouck, J.E., & Tindal, G. (1992). The Maze as a classroom-based reading measure: Construction methods, reliability, and validity. <i>The Journal of Special Education</i> , 26(2), 195-218.	Results from 14 published manuscripts and 5 other manuscripts are described with respect to the technical adequacy of Maze.	There are many different methods of Maze construction, including the way in which the multiple word choices are constructed and pictured, and the method in which distracters are chosen. Of the 14 published validity studies, all focused on concurrent criterion measures. Criterion validity between the Maze and other tests yielded a correlation coefficient of .63 and with teacher judgments, a coefficient of .50. Only 3 studies investigated alternate form reliability, and details of the findings were very limited.
Fuchs, L.S., Fuchs, D., Hamlett, C.L., & Ferguson, C. (1992). Effects of expert system consultation within curriculum-based measurement, using a reading Maze task. <i>Exceptional Children</i> , 58(5), 436-451.	33 special education teachers in 15 schools in a metropolitan area, who taught 63 students in grades 1-9.	Teachers in the experimental groups collected weekly data on their students' reading performance using a computerized Maze assessment system for 17 weeks. One third of the teachers received instructional consultation, one third received no consultation, and one third of the teachers did not collect weekly data on their students. Results indicated that students in the groups that were receiving the weekly monitoring performed better than students in the control group and teachers that received instructional consultation planned programs that were more instructionally diverse.
Fuchs, L.S. & Fuchs, D. (1992). Identifying a measure for monitoring student reading progress. <i>School Psychology Review</i> , 21(1), 45-58.	33 special educators with an average of 8.82 years of experience were the participants. 63 students with an average age of 12 were administered the measures.	The criterion validity of four alternative measures (question answering tests, recall, cloze, and Maze) of reading growth was assessed. For the Maze task, students were monitored twice weekly for 18 weeks using a computerized Maze system. The Maze measure was viewed as a better measure than retell or cloze with respect to the ability to detect growth on the graphs. In addition, teacher and student satisfaction with the Maze was high.

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Table 1: Selected studies of CBM Maze (continued from page 3)

STUDY	SUBJECTS (GENDER, AGE, GRADE LEVEL, DISABILITY)	FINDINGS
<p>Jenkins, J.R. & Jewell, M. (1993). Examining the validity of two measures for formative teaching: Reading aloud and Maze. <i>Exceptional Children</i>, 59(5), 421-432.</p>	<p>335 students in grades 2-6, with 17% receiving special education services.</p>	<p>The concurrent validity of oral reading fluency and Maze were examined using 1-minute Maze passages (total correct across 3 passages) and 1-minute oral reading samples (median number of words read correctly). Scores on the CBM measures were correlated with students' scores on the Gates Mac Ginitie Reading Tests, the Metropolitan Achievement Tests (MAT), and teacher judgments of students' reading proficiency. Correlations between the two standardized reading tests and both reading measures were highly and significantly correlated, with Maze correlation coefficients ranging from .65 to .76 with the Gates and .66 to .76 with the MAT. In addition, the Maze correlations did not seem to fluctuate and decrease as grade level increased, as the oral reading correlations did. Correlations between the Maze and teacher judgments ranged from .56 to .61.</p>
<p>Shin, J., Deno, S.L., & Espin, C. (2000). Technical adequacy of the Maze task for curriculum-based measurement of reading growth. <i>The Journal of Special Education</i>, 34(3), 164-172.</p>	<p>43 second grade students (25 males and 18 females) from three classrooms in a large, urban area</p>	<p>From September through June, monthly Maze passages were administered to students using the computerized Discourse system. Students completed the Maze passages for 3 minutes each time. Mean alternate form reliability was .81, and mean growth was statistically significant, meaning that there was reliable growth in Maze scores from month to month. There was a significant positive relationship between growth rates and reading scores on the California Tests of Achievement.</p>
<p>Ardoin, S.P., Witt, J.C., Suldo, S.M., Connell, J.E., Koenig, J.L., Resetar, J.L., Slider, N.J., & Williams, K.L. (2004). Examining the incremental benefits of administering a Maze and three versus one curriculum-based measurement reading probes when conducting universal screening. <i>School Psychology Review</i>, 33(2), 218-233.</p>	<p>77 students (35 female, 42 male) ranging in age from 8 to 10 years old. Students were enrolled in one of four regular education classes. Special education status was not provided.</p>	<p>Study purpose was to evaluate the use of 1 vs. 3 oral reading probes, oral reading alone, oral reading and Maze, or the ITBS as universal reading screening measures. The Maze correlated significantly with the Woodcock Johnson III Broad Reading and Passage Comprehension subtests, although oral reading CBM was found to be a better predictor of overall reading achievement and comprehension than the Maze.</p>
<p>Espin, C.A., Wallace, T., Lembke, E.S., & Campbell, H. (2004). <i>Preparing secondary students for state standards tests: Monitoring reading with curriculum-based measures</i>. Presentation at the National Conference of the Council for Exceptional Children, New Orleans, LA.</p>	<p>Study 1—238 8th grade students (136 females and 102 males) from 2 urban middle schools. 9 percent of students were receiving special education services. Study 2—32 8th grade students from 1 urban middle school.</p>	<p>Study 1—The research questions included: What is the validity and reliability of the Maze reading task as a measure of reading performance and what is the relationship between Curriculum-Based Measurement indicators of reading and performance on state standards tests in reading? Alternate form reliability ranged from .79 to .96 for the Maze measures. Criterion validity coefficients with the Minnesota Basic Standards Test (Minnesota's high stakes assessment) ranged from .75 to .81 for Maze, with similar coefficients for reading aloud. A 3-minute Maze measure served as the best predictor. Study 2—Addressed the validity and reliability of the Maze reading task as a measure of reading progress. Students were administered an oral reading and a Maze task each week for 10 weeks. Hierarchical Linear Modeling techniques were used to determine which measures were good indicators of progress. A 3-minute Maze task was a good indicator of progress, while oral reading did not demonstrate potential as a good indicator of progress.</p>
<p>Fuchs, L.S., Fuchs, D., Hamlett, C.L., Walz, L., & Germann, G. (1993). Formative evaluation of academic progress: How much growth can we expect? <i>School Psychology Review</i>, 22(1), 27-48.</p>	<p>Year 1—117 students in grades 1-6 from school districts in the upper Midwest in the reading portion of the study. 12% of the students were receiving special education services. Year 2—257 students in grades 1-6 from school districts in the upper Midwest participated in the reading portion (12% receiving special education services).</p>	<p>The purpose of this study was to determine what students' weekly rates of growth or slopes might be when CBM in oral reading and Maze is administered at least weekly (Year 1) or at least monthly (Year 2). For oral reading, slopes differed by grade level, while slopes remained consistent for Maze. Realistic and ambitious growth rates by grade for both oral reading and Maze are provided. Realistic and ambitious growth rates for oral reading were: 1.5 and 2.0 words per week (grade 2), 1.0 and 1.5 words per week (grade 3), .85 and 1.1 (grade 4), .5 and .8 (grade 5), and .3 and .65 (grade 6). Realistic and ambitious growth rates for Maze for grades 1-6 were .39 and .84 respectively, and did not differ by grade level.</p>

3. When should one use CBM Maze?

CBM Maze should be used whenever a teacher needs more reading data to support decision-making at the individual, group, class, grade, or school level. Positive results have been attained when CBM Maze has been used as a measure of overall reading proficiency for secondary students (Espin, et al., 2004). There are five basic uses of CBM Maze:

1. **To screen all students in a class, grade, or school.** CBM Maze can be used as a screening instrument to determine how students are doing in reading. Three Maze passages can be administered to all students three times per year, and the median score for each student can be used to create local norms for that school, grade, or classroom. The median score is used because this is the most stable indicator of student performance. Each student's median score can be compared to the median averages at the classroom or grade level to determine how that particular student is functioning compared to his/her peers. Following this, students who are achieving in the bottom percentage of each grade (i.e., the bottom 20% of each grade level) can be monitored on a weekly basis using Maze or oral reading.
2. **To monitor progress and make instructional decisions.** The most common use of CBM Maze is to monitor a group of students or an individual student in reading to determine if the instruction being provided is effective in increasing student performance. Student progress will be compared to long-range goals to determine whether additional or alternate instruction may be needed to allow students to reach their long-range goals. In addition, the ongoing and frequent data collection can support a teacher's documentation toward meeting state and federal standards such as Adequate Yearly Progress as part of the No Child Left Behind Act. Aimsweb, a computerized CBM system (Edformation) allows case managers to monitor their students within a Response to Intervention (RTI) system.
3. **To document prereferral interventions.** Teachers can use CBM maze to monitor the effectiveness of prereferral interventions. If a teacher uses CBM Maze, she can present the results of her attempts in a data-based format. The use of CBM Maze in the prereferral process is a very systematic way to look at the effects of each intervention.
4. **To document performance for special education evaluations.** CBM Maze data can be collected throughout the evaluation process to determine how well a student is progressing in the reading curriculum.
5. **To determine average classroom growth.** It is possible to aggregate all of the students' scores in a class (take the average) after each probe. By determining the average of each probe and graphing the scores, it is possible for a teacher to determine which students are growing more quickly, more slowly, or at the same rate as the class overall. Those growing more slowly than the class average can be monitored more closely and can be given additional academic support.



CBM Maze is not only a comprehension measure. CBM Maze correlates highly with both reading fluency and comprehension measures. It is an overall indicator of total reading performance.

4. What does one need to prepare to use CBM Maze?

Materials needed:

- Maze Probes (paper or computer versions)
- A stopwatch or other timing device
- Graph Paper or a computer graphing program

Maze Probes

The first step in preparing for CBM Maze is to create the probes that will be used to monitor student progress. You can create the Maze probes that will be used to monitor student progress or you can use passages that have already been created. Developing appropriate Maze probes for a student is described in step two of the next section, “How Do You Implement CBM Maze?”

Alternately, you can use Maze probes that are already developed. Maze passages can be downloaded and printed from edcheckup.com or from aimsweb.com. A computerized version of Maze, Monitoring Basic Skills Progress (Fuchs, Hamlett, & Fuchs, 1999), can be purchased through Pro-Ed (proedinc.com).

Stopwatch or Other Timing Device

An accurate stopwatch or other timing device is needed for reliable administration of the maze probes. You must be sure that you are only giving the student 2.5 minutes (elementary) or 3 minutes (secondary) to read each probe. It is a good idea to have a back-up timing device nearby in case yours does not work.

Graph Paper

You will need to use graph paper or a computerized graphing program to chart student data over time. By graphing a student’s data, you can quickly refer to the graph to see how a student is progressing. It also offers a nice visual aid when discussing a student’s reading progress with parents. In addition, you can compare students’ graphs within a class or a grade level to see how student performance varies.



When development of probes is complete, a teacher will probably spend 10-15 minutes per week administering and scoring CBM.

How long does it take to prepare to use CBM Maze?

Once the Maze probes have been developed, downloaded, or purchased, the amount of classroom time to implement the Maze CBM probes is minimal. It takes students 2.5 minutes (for elementary students) and 3 minutes (for secondary students) to complete the probes and approximately two minutes to score the probe and graph the student’s results. Overall, you will spend 10-15 minutes per week implementing the Maze CBM probes and graphing results. Decision-making using the graphed data is critical, and this is in addition to the 10-15 minutes per week implementing CBM Maze probes and graphing results.

5. How does one implement CBM Maze?

The basic steps to CBM Maze implementation follow. Appendix A includes a case study for a student with examples of each step.

School-wide screening

If you were to implement CBM Maze as a school-wide screening, you would follow the directions in Steps 1 and 2, and then you would administer three maze passages to all students in the school three times per year. You would identify the lowest percentage of each grade, and then would progress monitor those students using the following steps.

Progress Monitoring

Step 1—Determine what material you will use for the CBM Maze probes.

- Options include choosing reading material from books no longer used in the classroom, using modified newspaper passages (particularly effective for secondary students), or getting pre-made probes from a website. Sources for probes on-line are listed in the sections “How does one prepare to use the Maze?” and “Where can you get more information about CBM?”
- The probes should not be created from reading material the students have already read. Further, the reading level for each of the probes should not vary. In other words, if you begin monitoring a student using material at a 7th grade level, continue to use probes at the 7th grade level for each session.



It is important to make sure the reading level of Maze probes is similar for each administration to a student.

Step 2—Develop probes.

- For each probe, you will leave the first sentence of the passage intact.
- For each subsequent sentence, delete every seventh word and provide the correct word and two incorrect words, also known as distracters.
- The distracters should be within one letter in length of the correct word and should be easily identifiable (i.e., different part of speech (when possible), does not rhyme with the correct word, does not begin with the same letter as the correct word.) For example, if the correct word in the text is “cat”, you should not choose distracters that look similar to it such as “rat” and “bat.” Instead, you should choose distracters that are dissimilar such as “run” and “is”.
- Additional construction suggestions that you might consider include:
 - Put correct choices and distracters in bold and underlined.
 - Keep the Maze selections intact, rather than splitting at the end of lines.
 - If the seventh word is a proper noun, move one word forward or back.
 - Vary the placement of the correct Maze choice.
 - If the 7th word is the first word in the sentence, capitalize correct choice and distracters.
- Finally, ensure that the sentence will not make sense when read if one of the distracters is chosen as opposed to the correct word. Examples of student and teacher copies of a Maze passage are shown in Appendix B.

Step 3—Collect baseline data.

- Randomly select three probes to use in order to collect the baseline data.
- Administer the probes and give students 2.5 minutes (elementary) or 3 minutes (secondary) to circle as many correct choices as they can. The three passages can be administered consecutively in the same session, however it may be beneficial to administer the baseline probes in multiple sessions.
- Score the passages (Scoring rules can be found in Appendix D).
- Determine if the reading level of the three probes is appropriate for all of the students being monitored. If a student’s scores are very low, have the student read a probe to you. If the student cannot read at least 80% of the words independently, the probe reading level may be too difficult.



Setting both short- and long-term goals is vital to the efficacy of CBM Maze.

- If the probe reading level is too difficult for the student, choose successively lower level probes until the student's instructional level is reached. Use this level of reading material to develop the Maze probes.

Step 4—Decide on short-term objective or end criteria.

- After determining the baseline performance of each of the students, you need to decide on a weekly growth rate for each student (short-term objective) or an end criteria. Suggested rates of growth for students in grades 2 through 6 are provided below. Setting ambitious goals for students is always encouraged.

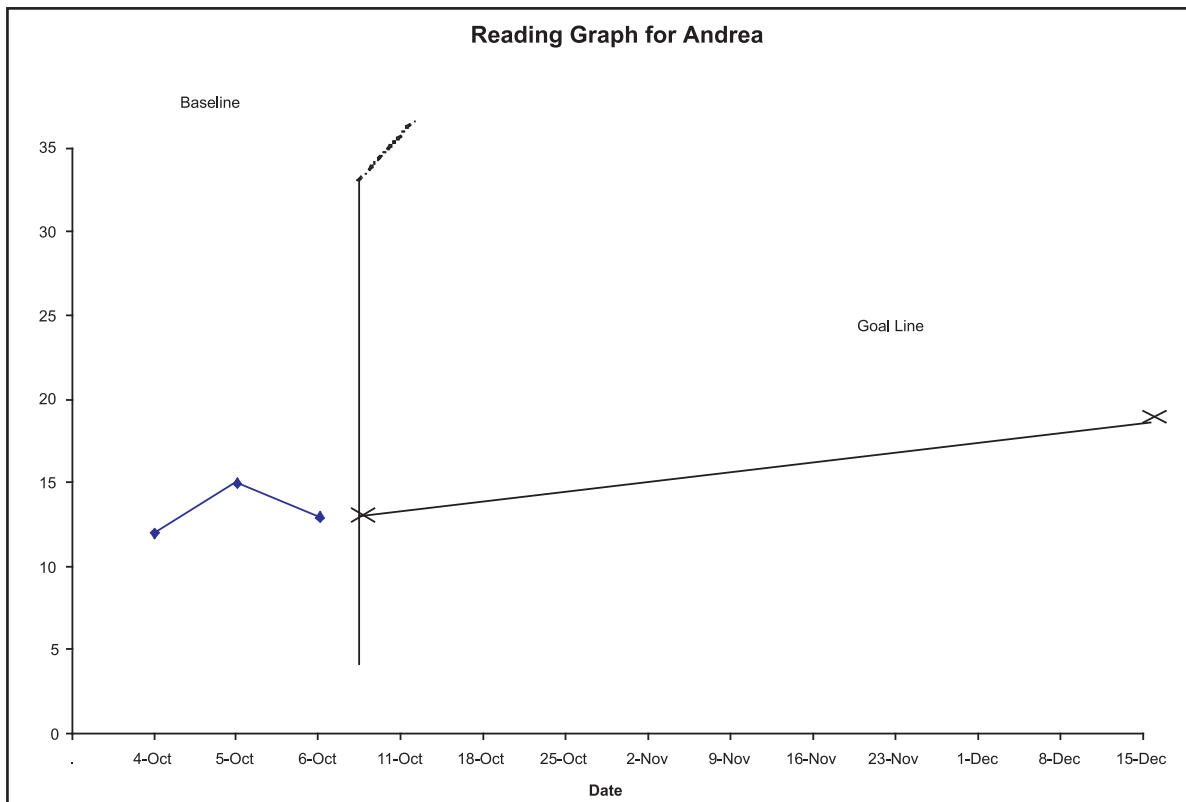
Grades	Realistic	Ambitious
2-6	.5 matches per week	1 match per week

- Alternatively, an end criteria may be set. This would mean determining in advance the number of correct matches you would like the student to be selecting by the end of the monitoring period. This end criteria might be a classroom, grade level, or school norm that has been previously determined (see “Why should you use CBM Maze, section 1).

Step 5—Set the long-range goal.

- Once you have determined the short-term objective to be used for each student, you can calculate the long-range goal. To set the long-range goal, you will need to know:
 - The end date of your goal
 - The number of weeks until your end date
 - The weekly growth rate (short-term objective) or end criterion
 - The median (middle) score from the three baseline probes.
- When you decide on a weekly growth rate:
 1. Multiply this growth rate by the number of weeks until the end date.
 2. Add this to your median baseline data point to get your long-range goal.
 For example, a student had the following three baseline scores: 12, 15, and 13. The teacher set a weekly growth rate of .5 more correct Maze choices per week. The end date for the instruction was 10 weeks later. To set the long-range goal, the teacher took the realistic growth rate of .5 Maze choices per week and multiplied it by the number of weeks ($10 \times .5 = 5$.) The teacher then added this score to the median baseline score of 13 ($13 + 5 = 18$). Therefore, the long-range goal for the student is 18 correctly maze choices in 2.5 minutes. A worksheet to use when calculating the long-range goal is provided in Appendix E.
- To place this long-range goal on a graph:
 1. Draw a vertical line to separate your baseline data from what will become your weekly data.
 2. On this vertical line, make an X on your median baseline score.
 3. Make another X on the final day of data collection based on your long-range goal.
 4. Connect these two X's to create your goal line.
 If we graphed the above example, the teacher would place an “X” on the number 13 on the vertical line that separates the baseline data from the intervention data. This is the starting point

of the long-range goal. The teacher would then place an “X” on the number 18 at the end of 10 weeks. This is the end of the long-range goal. The teacher would then connect the two “X’s” using a line. This is the long-range goal line. See Andrea’s graph below for an example.



- See the case study in Appendix A for an example of how to set the long-range goal.

Step 6—Decide how often to monitor.

- It is recommended that you collect CBM Maze data twice per week. This will help you detect small changes in growth that the student is making. At a minimum, data should be collected once per week.

Step 7—Begin monitoring.

- One to two times per week, randomly administer a Maze probe. Administration and scoring procedures are provided in Appendices C and D.

Step 8—Graph data.

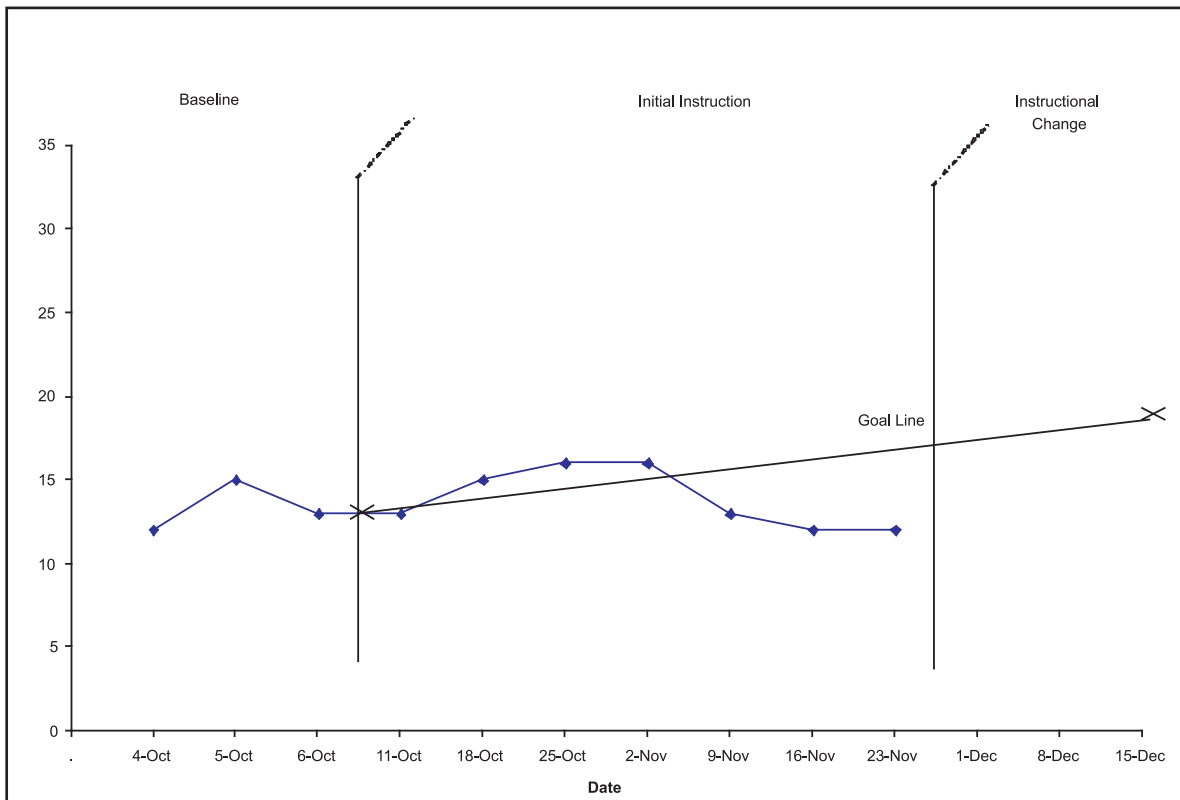
- Each time a Maze probe is administered, score the passage and graph the data on the appropriate student’s graph. Always examine the data to see whether or not the student is progressing towards his/her long-range goal.

Step 9—Make instructional changes using decision-making rules.

- As you collect each student’s data, compare it to the long-range goal that has been set
- Depending on the decision-making rules you have decided to use (see the options for decision-making rules in the next section, “How do you know CBM Maze is working?”), you will determine whether:
 - Instructional changes need to be made.
 - The student’s long-range goal needs to be raised.
 - The student is making adequate progress given the current instruction.
- *If the student is not making adequate progress towards the long-range goal, you will need to make an instructional change.*
 - Draw a new vertical line on the student’s graph to indicate an instructional change has been made.
 - Note the instructional change on the graph above the data.
 - A sample graph illustrating implementation of an instructional change is provided below.

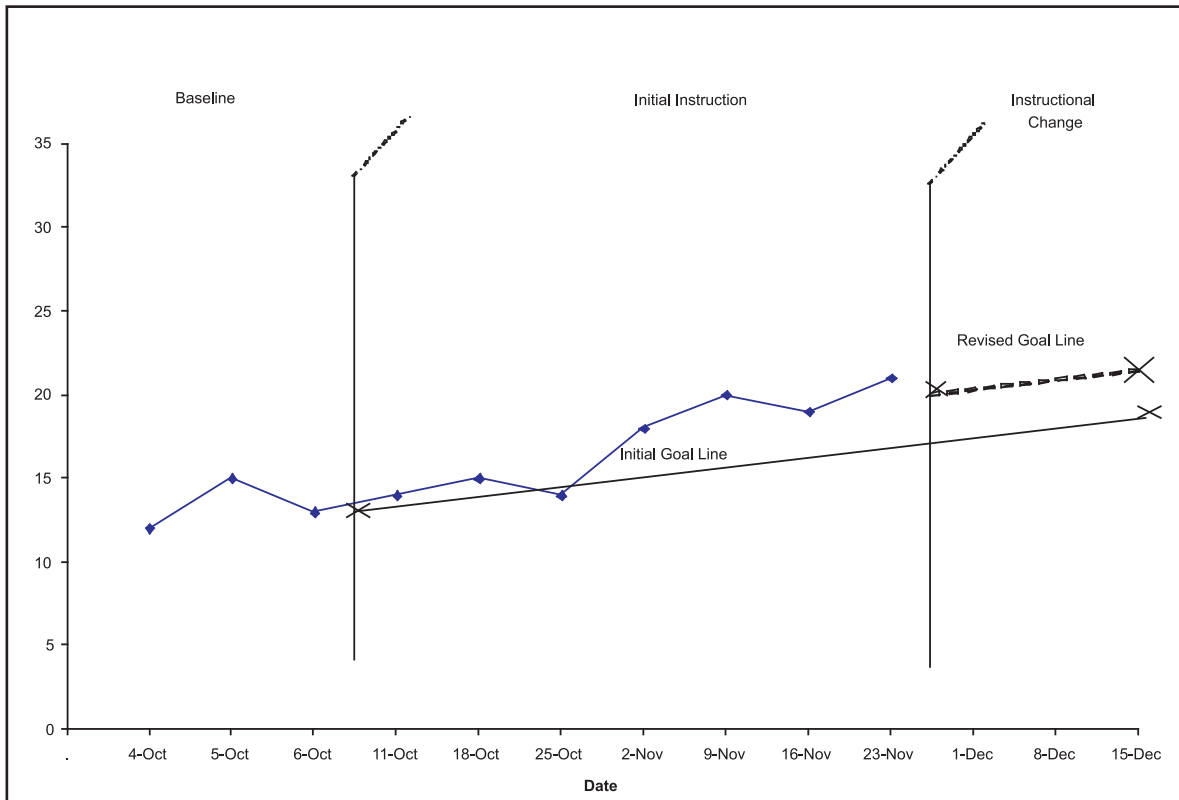


Determine decision-making rules as you begin to implement CBM Maze.



- *If the student has consistently surpassed his/her long-range goal (again, depending on the decision-making rules being used), you will need to raise the goal.*
 - Calculate a new baseline from the last three scores collected.
 - Draw a vertical line on the graph where the raised goal will begin.
 - Follow the procedures above in the section, “Setting the long-range goal.”

- A sample graph illustrating raising the long-range goal is provided below.



- *If the student is making adequate progress towards his/her long-range goal, continue the current instruction and monitoring.*

Step 10—Continue monitoring.

- Continue collecting Maze data with your student, graphing this data, and making decisions regarding instructional changes that need to be made.

Important points to remember

- Never give the same Maze probe twice during progress monitoring. A “practice effect” may occur.
- Graph the data each time a probe is given in order to compare the students’ progress to their long-range goals.

6. How does one know whether CBM Maze is working?

Remember, CBM is not a curriculum. It is a formative evaluation system that helps a teacher make decisions about student performance and instruction. Therefore, the question is not, “Is CBM Maze working for this student?” rather, the question is, “Based on the student’s CBM data, is my reading instruction helping this student learn to read?”

Examining the student’s scores on the Maze probes and comparing them to the long-range goal that the teacher sets for the student helps to address the question of whether or not your reading instruction is working for a particular student. There are three options for decision-making rules in CBM Maze:



One of the purposes of CBM Maze is to link teaching and evaluation to improve student learning.

- 1) AFTER A MINIMUM OF THREE WEEKS OF INSTRUCTION, *if the student has three consecutive data points below the long-range goal line*, the current instruction being provided the student is not as effective as you would like it to be. An instructional change is warranted. *If the student has six consecutive data points above the long-range goal line*, then the instruction is highly effective, and the long-range goal line for the student should be raised.
- 2) AFTER A MINIMUM OF FOUR WEEKS OF INSTRUCTION AND AT LEAST EIGHT DATA POINTS HAVE BEEN COLLECTED, calculate the trend of current performance and compare this trend line to the goal line. *If the trend of student progress is steeper than the goal line*, raise the goal. *If the trend of student progress is less steep than the goal line*, make an instructional change. Computer programs like Excel will calculate the trend line automatically, which eliminates the mathematics for less-daring practitioners.
- 3) COMPARE THE STUDENT’S RATE OF PROGRESS TO THE STANDARD RATE OF PROGRESS FOR STUDENTS AT THAT GRADE LEVEL. Standard rates of progress in Maze can be found in an article by Fuchs, L, Fuchs, D., Hamlett, Walz, & Germann (1993). Many of the web-based CBM systems such as Aimsweb and Edcheckup have their own benchmarks that teachers can use to make decisions about student performance and intervention implementation.

Sometimes teachers do have problems implementing Maze CBM procedures. Table 2 lists some of the most common problems.

Table 2: Common problems when implementing CBM

If this is happening...	Try This
Student scores are much lower than the median baseline score during the first few weeks of instruction.	1) If you feel that the student has been doing the best that he/she can on the probes, perhaps the probes are too difficult. Give the student three probes at the next lower level and recalculate the goal line. OR 2) If you feel the student is reading at the correct level, take a second baseline from the 3 most recent scores and recalculate the goal line.
Student scores or trend lines indicate that progress is not being made, based on the decision-making rule that was chosen.	Change your instruction. Implement an evidence-based reading intervention. See the section on “Where can one get additional information about Curriculum-Based Measurement and Evidence-based Reading interventions?” for more information on how to find evidence-based interventions.
Student scores or trend lines are above the long-range goal line, based on the decision-making rule that was chosen.	Raise the student’s long-range goal.
Student refuses to complete the passages or guesses on all Maze choices.	Ensure that the curriculum and passages developed are written at an instructional level for the student. The student should be able to independently read approximately 80% of the words correctly before any intervention. If the student cannot read 80% of the words independently, the instructional level of the materials may be too hard and a lower reading level should be used.
Student’s performance on the Maze passages is highly variable (the data “bounces around” on the graph)	Continue to graph the data. A student’s performance is often variable and is to be expected.

7. Where can one get additional information about Curriculum-Based Measurement and Evidence-Based Reading Interventions?

National Center on Student Progress Monitoring—<http://www.studentprogress.org>

- Web site that provides information and technical assistance on progress monitoring for elementary students.
- Watch for conference notices, as this technical assistance center funded by OSEP offers training in progress monitoring.

Research Institute on Progress Monitoring—<http://www.progressmonitoring.org>

- Web site that provides information regarding the OSEP-funded project to evaluate the effects of individualized instruction on access to and progress within the general education curriculum.
- Provides information on current and previous research in CBM, including a comprehensive literature review

AIMSweb, from Edformation—www.aimsweb.com

- Provides an online progress monitoring and graphing program, including measures to download (fee based). Maze measures are available.

Dynamic Indicators of Basic Early Literacy Skills—<http://dibels.uoregon.edu/>

- Research, benchmarks, administration directions, and probes for grades K-3; oral reading fluency passages also for grades 4-6 (free to download; fee per student for report access)

Edcheckup—www.edcheckup.com

- A website where individuals can access CBM probes and can graph students' data on the computer (fee-based). Maze measures are available.

Yearly Progress Pro from McGraw-Hill Digital Learning—www.mhdigitallearning.com

- Provides assessment tools, instructional feedback, and data reports and analysis in mathematics, reading, and language arts as well as instructional modules for students based on specific skills assessed (fee based).

Monitoring Basic Skills Progress—

http://www.proedinc.com/store/index.php?mode=product_detail&id=0840

- Link to the Pro-Ed site where this Macintosh computer program can be purchased for CBM Maze administration and scoring; also available for mathematics computation and concepts and applications (blackline masters available for mathematics CBM probes)

Intervention Central—www.interventioncentral.org

- A Web site developed by Jim Wright, a school psychologist from Syracuse, NY. This site contains numerous tools for creation, administration, and graphing of CBM measures, and includes ideas for research-based interventions (free).

Consortium on Reading Excellence (CORE)—www.corelearn.com

- Resources for evidence-based reading interventions

Division for Learning Disabilities (DLD) Research to Practice Web site—<http://www.teachingld.org/>

- Includes information about DLD's annual conference to provide information and training to teachers on research-based strategies and how teachers can implement these strategies in their classrooms. Check the conference schedule for sessions on progress monitoring, as many of these sessions have been included in the past.
- Web-based tutorials on CBM reading and Maze (among others) are also available to members on this Web site.

Oral Reading Fluency, 90 Years of Measurement. Behavioral Research and Teaching, Eugene, OR, 2005—http://brt.uoregon.edu/techreports/TR_33_NCORF_DescStats.pdf

- Recent oral reading fluency norms based on data for over 100,000 students

Put Reading First—http://www.nifl.gov/partnershipforreading/publications/reading_firstI.html

- Describes findings from the National Reading Panel report in a practitioner-oriented document. Includes reading activities that are evidence-based for each of the five big areas of reading.

Peer-Assisted Learning Strategies (PALS)—<http://kc.vanderbilt.edu/kennedy/pals/index.html>

- Web site includes information related to research support, obtaining materials and/or training,

University of Maryland's Project AIM's (Alternative Identification Models)—<http://www.glue.umd.edu/%7EEdlspeece/cbmreading/index.html>

- Provides passages for grades K-4, information on CBM, and administration directions (free).

University of Minnesota—www.education.umn.edu/research/CBM.htm

- This site provides a brief background and summary of CBM research at the University of Minnesota.

University of South Florida—<http://sss.usf.edu/cbm/SiteMap.htm>

- This site is maintained by the University of South Florida and provides resources and information regarding the use of CBM and DIBELS (Dynamic Indicators of Basic Early Literacy Skills).

Vanderbilt University—contact 615-343-4782 (Lynn and Doug Fuchs)

- May order CBM early literacy and reading probes for cost of copying and shipping.

Wireless Generation—www.wirelessgeneration.com

- Provides software for handheld computers that aids in monitoring student performance in reading (using the DIBELS, for example) and in math.

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Appendix A: Using CBM Maze to Monitor Individual Student Learning (Case Study)

Ms. Condrey is a fifth grade special education teacher at Peterson Elementary School. She teaches a self-contained reading class with ten students in it. She is interested in monitoring the progress of her entire class in reading to ensure that students are progressing and that students who need additional support can get it. Because Ms. Condrey is unwilling to take the instructional time out of her class that would be necessary to individually monitor her students using oral reading procedures, she decides to use the Maze procedure. She intends to monitor them over the course of an entire quarter (10 weeks.)

Step 1: Determine what material you will use for the Maze probes.

Because Ms. Condrey is interested in using Maze for monitoring all of her students, she needs to pick material that will be easy enough for her all of her students to read. If the material is too hard, the students will become frustrated when reading the probes and their scores will not improve. All of Ms. Condrey's students have significant difficulties in reading so she decides to create her Maze passages using a storybook written at the early second grade level.

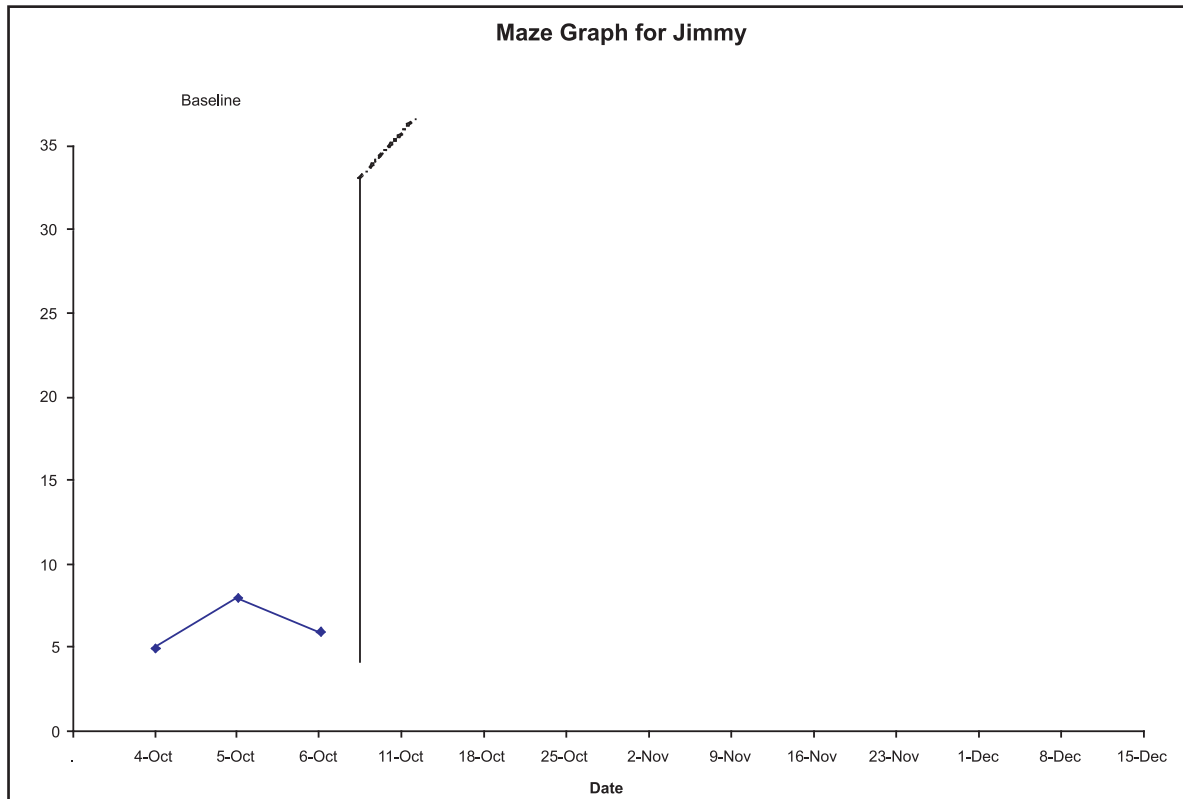
Step 2: Develop the Maze Probes

For each Maze probe, she leaves the first sentence intact and deletes every seventh word throughout the rest of the passage (see the section on "How do you implement CBM Maze?" for more details on creating probes.) For each deleted word, she supplies two distracters along with the correct word. The distracters are very similar in length, but are different parts of speech than the correct words. Ms. Condrey makes sure that all of the reading passages are long enough so that none of her students can finish the passages in the 2.5 minutes they have to work on them. Once all of the Maze probes are developed, she makes enough copies to administer to her entire class. She decides to administer one probe per week to her class.

Step 3: Collect Baseline Data

When Ms. Condrey administers the Maze probes, she places them face down on all of the students' desks and gives them instructions about how to mark their answers appropriately. She goes through a sample maze sentence on the board first. (Administration directions are provided in Appendix C). She then gives them 2.5 minutes in which to circle as many correct Maze choices as possible. Following the administration of the probes, she collects and scores them. Each student's score is placed on his/her own graph. For each student, the first three scores are used as their baseline data. *For the purposes of this case study we will use only one of her students, Jimmy, to illustrate the rest of the steps in using Maze.*

Jimmy's first three Maze scores are: 5, 8, and 6 correct Maze choices. Ms. Condrey plots these three scores on Jimmy's graph and takes the median (middle) score as the starting point for Jimmy's long-range goal.



Step 4: Decide on short-term objective or end criteria.

Ms. Condrey decides to set a short-term objective of an average increase of 1 correct Maze choice per week for her students. She feels this is a reasonable goal that is attainable for her students if she provides them with good systematic instruction.

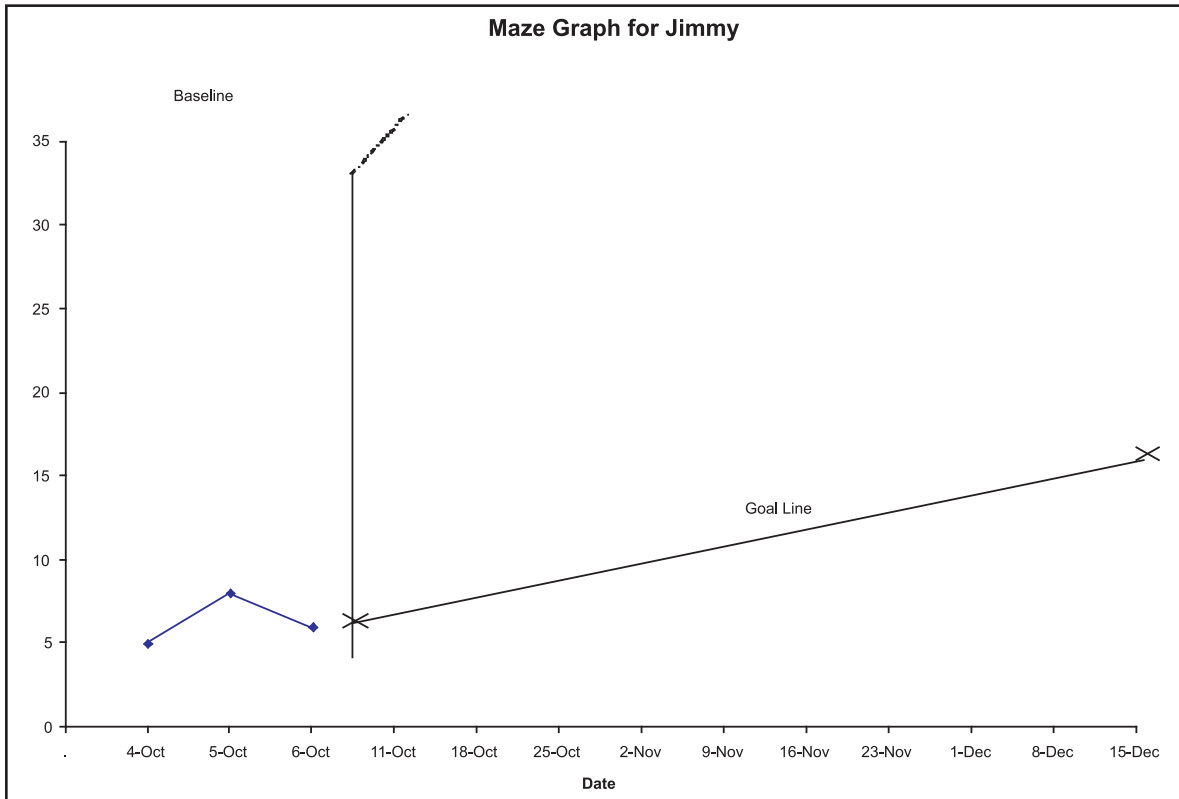
Step 5: Set the long-range goal (LRG).

Ms. Condrey uses the long-range goal worksheet (Appendix E) to calculate all of her students’ long-range goals. Jimmy’s three baseline data points were 5, 8, and 6. Ms. Condrey puts them in ascending order (5, 6, 8) and takes the middle score to get the median. Ms. Condrey draws a vertical line on Jimmy’s graph to separate the baseline data from the weekly progress data she will be collecting. On this line she places an “X” at the median score, 6.

Jimmy’s median baseline point	6
Criterion (short-term objective or end criterion)	1
Number of weeks until the end of progress monitoring	10

Calculate the LRG

Multiply the number of weeks by the criterion $\frac{10}{10} \times \frac{1}{6} = \frac{10}{60}$
 Add answer to median baseline $\frac{10}{10} + \frac{1}{6} = \frac{16}{60}$



Step 6: Decide how often to monitor.

Ms. Condrey decides to monitor her students’ progress once each week because this is her first time using Maze in her class. She hopes that she’ll be able to monitor twice per week once she gets a routine established. She wants to be able to quickly make changes to the reading instruction of individual students if they are not meeting their LRGs.

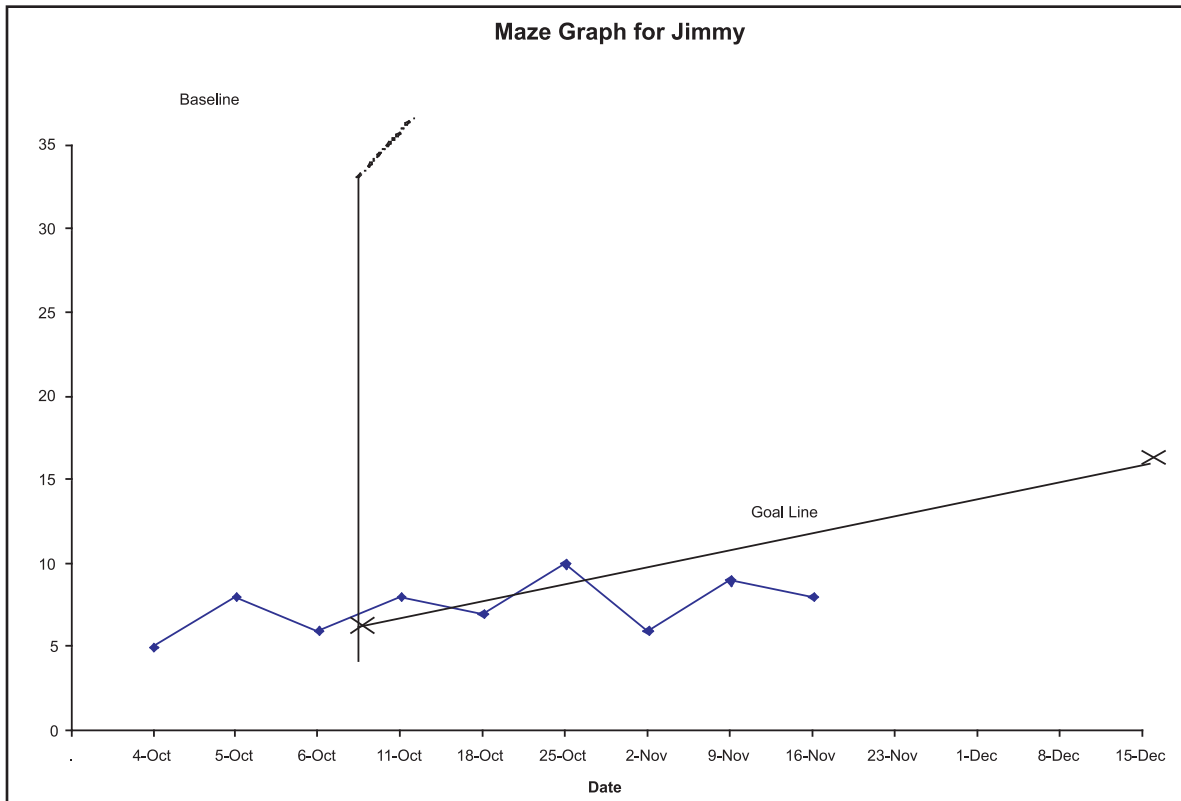
Step 7: Begin monitoring.

Ms. Condrey talks with her class about using the probes to determine how well they are learning to read. The class is willing to try it because the probes are only a few minutes long. They each sign a behavior contract agreeing to do their best on the probes. In exchange, Ms. Condrey agrees to a class party once a month.

Step 8: Graph the data.

After each administration of a Maze probe, Ms. Condrey individually graphs each student’s score from that day. She does not share the data with the students because she is concerned that the natural fluctuations in the data will discourage the students. Although she realizes that fluctuations in the data are natural (all students are variable in their performance), this may be a difficult concept for her students to understand.

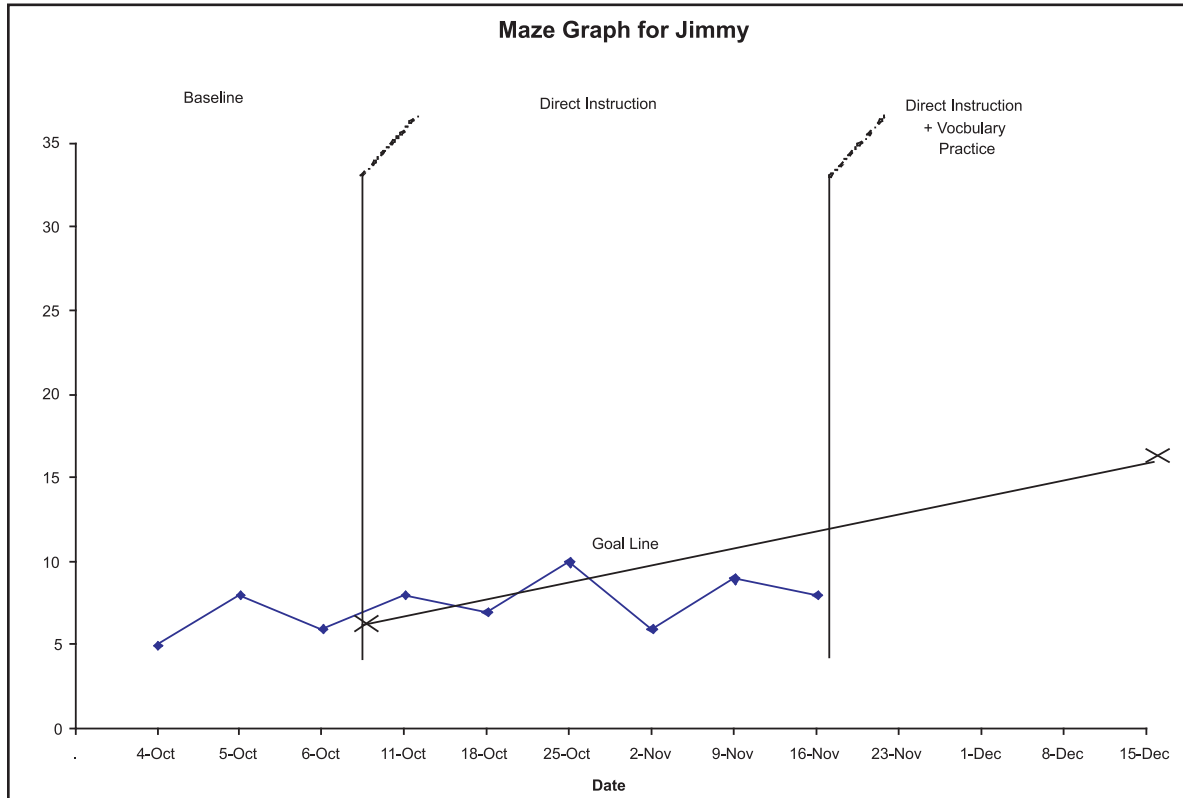
Below is an example of Jimmy’s data across several weeks.



Step 9: Make instructional changes using decision-making rules.

Ms. Condrey decides to use the following decision making rule for her class: If any student in the class gets three consecutive data points below the LRG (after three weeks of initial instruction), an instructional change to that student’s program will be made. If any student gets 6 consecutive data points above the LRG, his or her goal will be raised.

After collecting and graphing data for three weeks, Ms. Condrey examines all of her students’ graphs. Jimmy’s graph shows that he is no longer on track to make his long-range goal by the end of the quarter. Although his data show that he is not making adequate progress to reach his LRG, his data show that his overall reading is improving, just not at the level Ms. Condrey had hoped. Because Jimmy is improving (as illustrated by the upwards slope of his data), Ms. Condrey determines that she will continue to use the direct instruction program she has been using with her entire class but, for Jimmy, she will add an additional vocabulary practice component to his lessons. In this way, she hopes to further increase Jimmy’s reading achievement and increase his performance to meet his LRG. When Ms. Condrey implements this instructional change, she draws another vertical line on Jimmy’s graph to indicate a new intervention has been started and continues to collect data.



Step 10:

After making an instructional change for Jimmy and several of her other students based on the decision-making rules, Ms. Condrey continues to monitor their progress. In Jimmy's case, the addition of the direct vocabulary instruction is successful and Jimmy achieves his LRG. For several other students, however, the data indicate that the second intervention strategy is not successful. For these students, Ms. Condrey continues to implement further reading interventions, in an attempt to get each of the students to reach his/her long-range goal. Ms. Condrey realizes that no two students in her class are alike and some require four or five different interventions until progress towards the long-range goal is seen, while others meet their long-range goal with only one intervention. Ms. Condrey appreciates that CBM allows her to individualize instruction for her students based on their specific needs.

Appendix B: Example of student and teacher copies of a Maze passage (partial passages)

Student copy—Maze passage

One morning, George and his mother decided to go to the grocery store. George went into his bedroom and too / got / real some money out of his piggy bank / are / onto. He was excited to get himself I / to / a treat! George's mother walked and George paper / rode / tie his bike. When he would ride too / line / us far ahead, George's mother would call to / can / as him "Slow down!" They finally got be / is / to the store. George locked his bike she / and / to the bike rack and he and his / name / on mother went inside.

Teacher copy—Scored Maze passage

One morning, George and his mother decided to go to the grocery store. George went into his bedroom and too / (got) / real some money out of his piggy bank / (~~are~~) / onto. He was excited to get himself I / to / (a) treat! George's mother walked and George paper / (rode) / tie his bike. When he would ride too / (~~line~~) / us far ahead, George's mother would call (to) / can / as him "Slow down!" They finally got be / is / (to) the store. George locked his bike she / (~~and~~) / to the bike rack and he and (his) / name / on mother went inside.

Score-6 correct, 3 incorrect. Number graphed-6

Appendix C: Administration directions for Maze

Materials:

- Teacher copy of Maze probe with correct answers circled
- Pencil
- Student copy of the Maze probe
- Stopwatch

Directions:

First, provide students with a sample sentence with a maze choice on the board. Complete the sentence orally together.

Say to the students: **Read the passage, and whenever you come to three word choices, circle the word that belongs in the sentence. Circle a word even if you're not sure of the answer. Continue working until I tell you to stop. Remember to do the best you can. Ready? Begin.**

After 2.5 to 3 minutes say: **Stop. Thank you. Put your pencils down.**

Note:

- If students ask you to identify a word, do not give them the word. Remind them to just do the best they can.
- In order to maintain reliability, please keep a close watch on the timing of the test. Have a back-up (clock or watch) available in case your stopwatch doesn't work.

Appendix D: Scoring rules for Maze probes

Scoring

1. Mark a line through any incorrect choice the student has made. Skips are counted as incorrect. If two answers are circled, score the item as incorrect. If you are unsure of the student's choice, score the item as incorrect.
2. Once the student has made three errors in a row, stop scoring.
3. Return to the last correctly chosen word.
4. Count the number of correct choices selected prior to the first of the three consecutive errors. Do not count any choices made after the first of the three consecutive errors.

Appendix E: Long-range goal worksheet

Gather information

Median baseline point _____

Criterion (expected rate of growth per week or end criterion) _____

Number of weeks until the end of progress monitoring _____

Calculate LRG

Multiply number of weeks by criterion. _____ X _____ = _____

OR

Write in end criterion. _____

Add answer to median baseline. _____ + _____ = _____

Place an "X" on graph to signify LRG.

Place an "X" on graph to signify the median baseline point.

Connect the two X's to make the goal line.