Chapter 7
Collecting and Documenting Evidence of Student Learning: Analysis of Student Work

The *Analysis of Student Work* part of the Learning Record (page 3 of the Data Collection Form) provides for a more in-depth examination of what the student has accomplished than the *Observation Notes*. At least three samples of student work should be analyzed and commented on during the year for inclusion in the Learning Record. As much as possible, the work chosen for analysis should be significant—the work should show important understandings the student has gained. The work may be an assessment given in class, an investigation the student may have worked on for a number of days, a classroom presentation, an interview by the teacher, or even a regular assignment that turns out to be particularly relevant for that student. It is important to include a dated copy of the student's work or some written record of an oral interview or presentation along with the analysis done on the recording form.

How do I determine what student work to analyze? This is a question teachers frequently ask. There is no one correct answer. Each teacher will need to determine the criteria to use in choosing the work to include in a student's Learning Record. A teacher also will need to determine whether there will be differences in the kind of work included in different student's records. There are a number of questions to consider when selecting the student work to analyze.

- What kinds of tasks, problems, or assessment should be chosen?
- How representative are the samples selected for the LR of the work done regularly by the student?
- What areas of mathematics are represented in the work samples?
- What role does the student play in selecting the work?

- When, or how often, should work samples be collected?
- How should the work be analyzed and recorded on the Data Collection Form?

These questions are discussed below.

The samples of work selected for the *Analysis of Mathematics Work* section of the Learning Record should be significant for the student's mathematical learning and provide clear evidence of the student's conceptual level of mathematical understanding. The work, therefore, should reflect some of the important mathematical goals for the year as defined by the descriptors in the LR Mathematical Understanding and Disposition Scales. Work that requires time, perhaps over several days, is generally better to include than brief or routine assignments. Students need to explain their thinking, such as reasons for their choices of strategies and why their solutions make sense. Especially, as students get older, work that involves complex problems calling for students to analyze situations and make mathematical connections is desirable.

Since only a few analyses of a student's work will be done during the year, it is impossible to provide evidence of understanding of all the important mathematical ideas contained in the grade level descriptors of the Mathematical Understanding Scale. Some teachers choose to focus on one area of mathematics, such as Number Sense, so that one can see the student's progress in that area as the year goes on. This may also be true for high school teachers who are teaching a course focused on one area, such as geometry. Other teachers want to select work samples from different mathematical areas to show the comprehensiveness of the student's understandings. Teachers who are using the Learning Record to improve and broaden their mathematics program over a period of several years may find that their choices of the mathematical areas of the student work samples change as their curriculum becomes more comprehensive.

Many teachers involve the students in selecting the work to include. This encourages students to think about their own learning and reflect upon what

constitutes quality work. Some teachers, especially those at the upper grades, involve their students in posing the problems they will investigate and solve.

Some teachers want to make sure that the three analyses are spread out throughout the year, with one in the fall, winter, and spring. Other teachers want to include more evidence that is collected toward the end of the year, perhaps from January on, to provide evidence of what mathematical understandings the student has acquired during the year.

Each teacher will need to consider carefully the kinds of work to include in each student's LR. Many teachers new to using the math component of the LR are just beginning to implement a mathematics program that routinely integrates complex tasks or investigations into their curriculum. Students may not be used to explaining their thinking and reasoning. Student work that shows only mastery of procedures, without any evidence of understanding, will be lacking in evidence called for in the Mathematics Scales. However, a student's LR that consists only of a few problems that the teacher has received in a workshop is also misleading since it does not reflect what the student is doing and understands in the classroom on a day-to-day basis. As much as possible, an LR from a student in a classroom beginning to implement the Learning Record should provide evidence of the student's conceptual understanding. It would also be informative to indicate whether this evidence is representative of work from the regular mathematics program. If it is not representative, it may be useful to include a few work samples that are indicative of the student's progress in the classroom program.

Doing and Recording Analysis of Mathematics Work

The record keeping for the *Analysis of Mathematics Work* takes more thought than that done for the *Observation Notes*. Rather than just recording what happened, as for the *Observation Notes*, the *Analysis of Mathematics Work* requires the teacher (and/or student) to do some interpretation of the student's work. Therefore, teachers may want to plan how they are going to do the analyses of the work of multiple students. Some teachers decide to do analysis

of about one student's work per week. Other teachers may do an analysis of important task/assignment for several students and use the results to benefit the whole class. (As stated earlier, teachers who are beginning to use the mathematics component of the Learning Record should collect records for just a few students during the first year.)

On the Data Collection Form, the sections down the left side of page 3 provide a framework for the analysis, and include the following.

- Dates and area(s) of mathematics. What area(s) is the task related to—number sense; patterns, functions, and algebra; geometry and measurement; or data analysis, statistics, and probability; or a combination of different mathematical areas? (Make sure the date is also included on the work samples included in the portfolio.)
- Task/activity and specific mathematical ideas. What is the title of the task, or how can it be identified? What, specifically, are the important mathematical ideas embedded within the task?
- Context. What was the setting for the task? What kind of task was it—a typical homework assignment, a end of unit test, an interview; an investigation or long-term project, and/or a presentation? How much time did the student have to work on the assignment? Did the student work alone, with one other, in a small group, or did the parents help at home?
- Engagement/response. How challenging and engaging was the task for the student? What was the student's response to the task? Did the student work on the task with confidence? Did the student give up easily or show an ability to persevere? To what degree did the student show independent thought? Was the student able to describe how and what he/she was learning to do and to understand? Was the student able to reflect and self-assess the quality of his/her work and how it could be improved? (These judgments may be hard to make if the teacher did not observe the student at work. For some tasks, evidence may be conveyed in the student's written response. The teacher may wish to talk with the

student or ask him to write about his or her engagement/response with the task.)

- Doing Mathematics. How did the student work on the task?
  Strategies and approaches: To what degree did the student generate his/her own solution plan? Did the student use a practiced procedure or make choices and use multiple ways to complete the task?
  Communication: To what degree was the student able to explain and/or justify his/her mathematical thinking: Did he/she record his/her methods and results? Did the student interpret his/her solutions or merely report them? Did the student listen to others' explanations, particularly those explanations that ran counter to his/her solution?
  Connecting and reasoning: Did the student use mathematical relationships to connect mathematical ideas to make sense of the task and in his/her explanation of the methods used and the solution? Is there evidence that the student can apply the ideas to a range of tasks in other class work and outside of school? To what degree did the student make a mathematical argument and/or create a proof to support his/her thinking?
- Mathematical knowledge and understanding exhibited and What this sample shows about the student's mathematical development . Based on the evidence from this task, what is the student's current level of mathematical knowledge and understanding? How well has the student been able to show what he/she knows about the mathematical ideas embedded in the task? How deep of an understanding has the student exhibited? What evidence is there that the student is adding to his/her personal knowledge and understanding? (The Mathematical Understanding Scale will be a useful reference for completing this section.)
- Experiences/support needed to further development. What does this analysis suggest for next steps? This section takes into account what has been said in the other sections to plan future work for the student and to use when meeting with parents. This assessment of the work sample informs instruction and should be referenced when summarizing the year's work later.

It is not necessary to write a response for every bullet listed along the side. They are there to help guide your thinking as you as you analyze student work. Since the space for each response is so limited, it is important to try to capture the critical aspects of the student's work when completing this page.

As students get older, they can take on some or most of the responsibility for analyzing and recording comments about their work on this page of the LR. Students can take responsibility when teachers have worked over a period of time with students in their classes to make sure that the students are familiar with and understand the Mathematical Understanding and Disposition Scales, and have had many experiences in analyzing their own work, in conjunction with the teacher and (probably) other students.

Because single tasks or assignments tend to be quite limited, it is tempting to make judgments about a student's mathematical understanding beyond the evidence exhibited by the student's work. Therefore, care should be taken to base comments on what is shown in the work analyzed. Of course, "richer" and more complex tasks usually provide more opportunity for a student to show their mathematical understandings.

To Do: **Examples of Analysis of Student Work**

If you LR coach has copies of Glen's LR, examine the analysis section and Glen's work before reviewing the work from the samples included in this Handbook. Further examples of *Analysis of Student Work* is included for the following students.

- Tessa, Grade 1 (See pages 8-10.)
- Michelle, Grade 7 (See pages 11-15.)

The first page of each section includes a brief introduction about the work samples and the commentary. Following is a copy of the analysis page of the form and the student's work. For ease in examining the work, you may want to remove the appropriate pages from the Handbook. General suggestions for reviewing the work are included in Chapter 5, pages, 3-4.

Glen, Grade 4. Glen's teacher selected work done near the beginning (November 13), middle (January 19), and end (April 25) of the school year. Two of the tasks were from Number Sense and the other from Geometry. All the assignments were quite large, completed over a period of days. However, the context of each task was different—one was a "Problem of the week" worked on in class and/or at home, one was a set of activities completed in class, and the third was a longer investigation/report. All were worked on both individually and with others, although the write-up of each assignment was done by Glen.

If you have not done the three tasks, do them before looking at Glen's work and the teacher's commentary about his work. After reviewing his work and the commentary, you may want to discuss the following questions.

- By examining the three samples of Glen's work and the teacher's commentary, what do you know about Glen's understanding of mathematical concepts and his mathematical disposition. Can you identify evidence in his work that supports the teacher's commentary and your conclusions?
- What assumptions are impossible or difficult to make based on the evidence in Glen's work and the commentary?
- How does the evidence relate to the Mathematical Understanding and the Mathematical Disposition Scales? Please note that the evidence (work and commentary) from any of the tasks, or even all three of the tasks, is insufficient to make a placement of Glen on the Mathematics Scales.

Tessa, Grade 1. Tessa's teacher gave three tasks that were done in an interview setting. The recording of the teacher's analyses indicate that the first task was given during a unit on probability, and the other two are from the area of Number Sense. The teacher took notes on Tessa's responses during the interviews. (Notes from the third task are not included.) The teacher's analysis works along with the interview notes to give a picture of Tessa's (1) understanding of the meaning of "most likely" on a spinner, (2) beginning ability to see relationships betweens grouping and counting by tens and by ones when using materials, and (3) knowledge of and ability to write addition combinations for the number 7 without using materials.

Michelle, Grade 7. Michelle's LR includes the following three tasks.

- "Airplane Scatterplot"—A data analysis task that asks students to use given data to make a scatterplot, and seems to be an introduction to the concept of correlation. (See page 12.)
- "Shopping Spree"—An open-ended problem involving finding equivalent fractions, decimals, and percents, and constructing a circle graph. It appears that the product prices were created by Michelle. (See page 13.)
- "Cockroach Condos"—A task from Patterns, Functions, and Algebra asking students to build various block "condos" following specific rules, record the relationship between the number of layers in a condo and the number of blocks required to build it in a T-chart, write an equation for each relationship, and graph the ordered pairs. (See pages 14-15.)

If you have not done the three tasks, do them before looking at Michelle's work and the teacher's commentary. Then following the suggestions for reviewing Glen's work on page 7 of this chapter.

Jana, Grade 9. Jana is a student in an integrated (algebra/geometry) Math 1 class. Two samples of her work are included. For each sample, the task is written on the first page to encourage you to do the problem before looking at Jana's work. Jana's write-up follows the task to encourage you to think about what you might write on the *Analysis* form before reviewing the teacher's analysis.

- Probabability Unit Assessment—This included three tasks: Peculiar Dice, Country Fair, and a reflective homework assignment. The task is on page 17; Jana's work is on page 18-19, and the teacher's commentary is on page 20.
- "Pie Cutting"—This is a "Problem of the Week." Students have one week to do the task and write-up their response. The task in on page 21, Jana's work is on pages 22-23, and the teacher's commentary is on page 24.

[The samples referred to are not available now that the CLL is closed.]]