THE TASK ANALYSIS GUIDE

Lower-Level Demands

Memorization Tasks

• involve either reproducing previously learned facts, rules, formulae, or definitions OR committing facts, rules, formulae, or definitions to memory.
• cannot be solved using procedures because a procedure does not exist or because the time frame in which the task is being completed is too short to use a procedure.
• are not ambiguous—such tasks involve exact reproduction of previously seen material and what is to be reproduced is clearly and directly stated.
• have no connection to the concepts or meaning that underlie the facts, rules, formulae, or definitions being learned or reproduced.

Procedures Without Connections Tasks

• are algorithmic. Use of the procedure is either specifically called for or its use is evident based on prior instruction, experience, or placement of the task.
• require limited cognitive demand for successful completion. There is little ambiguity about what needs to be done and how to do it.
• have no connection to the concepts or meaning that underlie the procedure being used.
• are focused on producing correct answers rather than developing mathematical understanding.
• require no explanations, or explanations that focus solely on describing the procedure that was used.

Higher-Level Demands

Procedures With Connections Tasks

• focus students’ attention on the use of procedures for the purpose of developing deeper levels of understanding of mathematical concepts and ideas.
• suggest pathways to follow (explicitly or implicitly) that are broad general procedures that have close connections to underlying conceptual ideas as opposed to narrow algorithms that are opaque with respect to underlying concepts.
• usually are represented in multiple ways (e.g., visual diagrams, manipulatives, symbols, problem situations). Making connections among multiple representations helps to develop meaning.
• require some degree of cognitive effort. Although general procedures may be followed, they cannot be followed mindlessly. Students need to engage with the conceptual ideas that underlie the procedures in order to successfully complete the task and develop understanding.

Doing Mathematics Tasks

• require complex and nonalgorithmic thinking (i.e., there is not a predictable, well-rehearsed approach or pathway explicitly suggested by the task, task instructions, or a worked-out example).
• require students to explore and understand the nature of mathematical concepts, processes, or relationships.
• demand self-monitoring or self-regulation of one’s own cognitive processes.
• require students to access relevant knowledge and experiences and make appropriate use of them in working through the task.
• require students to analyze the task and actively examine task constraints that may limit possible solution strategies and solutions.
• require considerable cognitive effort and may involve some level of anxiety for the student due to the unpredictable nature of the solution process required.

FIGURE 1.2. The characteristics of mathematical tasks at each of the four levels of cognitive demand (Stein & Smith, 1998). (Reprinted with permission from Mathematics Teaching in the Middle School, copyright 1998 by the National Council of Teachers of Mathematics. All rights reserved.)
**TASK A**

**Manipulatives/Tools:** Counters

For homework, Mark’s teacher asked him to look at the pattern below and draw the figure that should come next.

Mark does not know how to find the next figure.
A. Draw the next figure for Mark.
B. Write a description for Mark telling him how you know which figure comes next.

**QUASAR Project - QUASAR Cognitive Assessment Instrument - Release Task**

**TASK B**

**Manipulatives/Tools:** None

Part A: After the first two games of the season, the best player on the girls’ basketball team had made 12 out of 20 free throws. The best player on the boys’ basketball team had made 14 out of 25 free throws. Which player had made the greater percent of free throws?

Part B: The “better” player had to sit out the third game due to an injury. How many baskets (out of an additional 10 free throw “tries”) would the other player need to make in order to take the lead in terms of greatest percentage of free throws?


**TASK C**

**Manipulatives/Tools:** Calculator

Your school’s science club has decided to do a special project on nature photography. They decided to take a little over 300 outdoor photos in a variety of natural settings and in all different types of weather. Eventually they want to organize some of the best photos into a display and enter the Stare Nature Photography contest. The club was thinking of buying a 35mm camera, but someone in the club suggested that it might be better to buy disposable cameras instead. The regular camera with auto-focus and automatic light meter would cost about $40.00 and film would cost $3.95 for 24 exposures and $5.95 for 36 exposures. The disposable cameras could be purchased in packs of three for $20.00 with two of the three taking 24 pictures and the third one taking 36 pictures. Single disposables could be purchased for $8.95. The club officers have to decide which would be the best option and they have to justify their decisions to the club advisor. Do you think they should purchase the regular camera or the disposable cameras? Write a justification that clearly explains your reasoning.

**TASK D**

**Manipulatives/Tools:** None

The cost of a sweater at J. C. Penney’s was $45.00. At the “Day and Night” sale it was marked 30% off of the original price. What was the price of the sweater during the sale? Explain the process you used to find the sale price.

**TASK E**

**Manipulatives/Tools:** Pattern Blocks

1/2 of 3/4 means one equal part of one-third.

Find 1/2 of 1/4. Use pattern blocks. Draw your answer.

**TASK F**

**Manipulatives/Tools:** Square Pattern Tiles

Using the side of a square pattern tile as a measure, find the perimeter (i.e., distance around) of each train in the pattern block figure shown below.

Train 1
Train 2
Train 3

**TASK G**

**Manipulatives/Tools:** Grid Paper

The pairs of numbers in a-d below represent the heights of stacks of cubes to be leveled off. On grid paper, sketch the front views of columns of cubes with these heights before and after they are leveled off. Write a statement under the sketches that explains how your method of leveling off is related to finding the average of the two numbers.

a) 14 and 8  b) 16 and 7  c) 7 and 12  d) 13 and 15

By taking 2 blocks off the first stack and giving them to the second stack, I’ve made the two stacks the same. So the total # of cubes is now distributed into 2 columns of equal height. And that is what average means.

Taken from *Visual Mathematics* (Bennett & Foreman, 1989)

**TABLE 1.3.** Sample tasks that have been used in a sorting activity.