**Collection of Worthwhile Mathematical Tasks and Rationales (Max: 30 Pts)**

The NCTM *Professional Standards for Teaching Mathematics* (1991) emphasizes the posing of learning activities it calls *worthwhile mathematical tasks*. These tasks are to be based on—

* Sound and significant mathematics;
* Knowledge of students’ understandings, interests, and experiences;
* Knowledge of the range of ways that diverse students learn mathematics;

And these tasks are intended to—

* Engage students’ intellect
* Develop students’ mathematical understandings and skills; stimulate students to make connections and develop a coherent framework for mathematical ideas;
* Call for problem formulation, problem solving, and mathematical reasoning;
* Promote communication about mathematics;
* Represent mathematics as an ongoing human activity;
* Display sensitivity to, and draw on, students’ diverse background experiences and dispositions;
* Promote the development of all students’ dispositions to do mathematics. (p. 25)

Further, “In selecting, adapting, or generating mathematical tasks, teachers must base their decisions on three areas of concern: the mathematical content, the students, and the ways in which students learn mathematics” (p. 25-26)

Stein, Smith, Henningsen, and Silver (2000) encourage the analysis of mathematics instructional tasks for “the kind and level of thinking required of students in order to successfully engage with and solve the task” (p. 11). Their analysis of *cognitive demands* divides mathematics tasks into two general categories, each of which are divided further into two subcategories: *Lower-Level Demands* (including *Memorization Tasks* and *Procedures Without Connections Tasks*) and *Higher-Level Demands* (including *Procedures With Connections Tasks* and *Doing Mathematics Tasks*). “Since the tasks with which students become engaged in the classroom form the basis of their opportunities for learning mathematics, it is important to be clear about one’s goals for student learning. Once learning goals for students have been clearly articulated, tasks can be selected or created to match these goals. Being aware of the cognitive demands of tasks is a central consideration in this matching” (p. 11).

The NCTM *Principles and Standards for School Mathematics* (2000) elaborates on the role of problem solving in learning mathematics by specifying that—

**Instructional programs from prekindergarten through grade 12 should enable all students to—**

* build new mathematical knowledge through problem solving;
* solve problems that arise in mathematics and in other contexts;
* apply and adapt a variety of appropriate strategies to solve problems;
* monitor and reflect on the process of mathematical problem solving. (p. 51)

“Problem solving means engaging in a task for which the solution method is not known in advance. [The 1989 NCTM *Curriculum and Evaluation Standards* called this *nonroutine* problem solving.] In order to find a solution, students must draw on their knowledge, and through this process, they will often develop new mathematical understandings. Solving problems is not only a goal of learning mathematics but also a major means of doing so. Students should have frequent opportunities to formulate, grapple with, and solve complex problems that require a significant amount of effort and should then be encouraged to reflect on their thinking.” (NCTM, 2000, p. 51)

**Tasks and Rationales:**

Select, adapt, or generate (and organize) three (3) worthwhile mathematical tasks across grades P-5 focusing on developing understanding of the major concepts of **number, operations, and algebra**. For each of the tasks in the collection, provide a complete solution strategy of your own work. Following your problem and solution, explain in writing your thinking used to complete the task. After each task collected, provide an analysis page that identifies the following (refer to Stein, Smith, Henningsen, & Silver, 2000):

* Anticipated students (age, grade level, and prior knowledge/experience);
* Goals for student learning (from CCGPS, GSE, or NCTM Standards);
* Mathematical features of the task, including what students are asked to do, in what context, with what tools (including the impact of the use of calculators or other technology), etc.;
* Level of cognitive demands (doing mathematics or procedures with connections to specific math content);
* Rationale for the categorization of cognitive demands (using language from Stein et al. (2000) guidelines)
* Carefully worked out solutions, with explanations for each step in the process

Attach this page following each worthwhile mathematical task along with your solving the worthwhile mathematical task and your explanation of mathematical thinking to complete the task.

In addition to submitting this collection of worthwhile mathematical tasks, choose one of the 3 tasks to present to the class. During this presentation: (1) state the relevant grade levels, (2) state the goals for student learning, (3) present the task by having classmates engage in the task, and (4) state the level of cognitive demand, including rationales for this level of cognitive demand. You will be provided an opportunity in class to sign up for the worthwhile mathematical task you have chosen as well as a presentation time.