Rich, Worthwhile Mathematical Tasks

The teacher gives the students a problem situation in which the solutions or answers are not necessarily determined in only one way. The teacher then makes use of the diversity of approaches to the problem in order to give students experiences in finding or discovering new things by combining all the knowledge, skills, and mathematical ways of thinking they have previously learned. NCTM, (2000)

Good problems give students the chance to solidify and extend what they know and, when well chose, can stimulate mathematical learning. NCTM, (2000)

Good tasks can and should be used to help students develop fluency with specific skills. NCTM, (2000)

Provides opportunities for students to figure things out for themselves. NCTM, (2000)

Different tasks provide opportunities for student learning. Tasks that ask students to perform a memorized procedure in a routine manner lead to one type of opportunity for student thinking; tasks that demand engagement with concepts and that stimulate students to make connections lead to a different set of opportunities for student thinking. (Smith & Stein, 2011)

It is critical that the task that a teacher selects align with the goals of the lesson. (Smith & Stein, 2011)

Reflect high cognitive demand. (Stein et. al., 1996)

Tasks with high levels of cognitive demand are described as *procedures with connections* (the meaningful use of procedures in ways that are connected to concepts or understanding) or as *doing mathematics* (the process of active inquiry where no pathway is specified or implied); low level tasks are described as *procedures without connections* (use of procedures, formulas, or algorithms in ways that are not actively linked to meaning) or *memorization* (reproduction of previously memorized facts). (Boston & Smith, 2011)

Mathematical task: A segment of classroom activity that is devoted to the development of a particular mathematical idea. (Stein & Smith, 1998) Contain important and relevant content. (Bornemann, Haury, & Slavit, 2009)

Multiple ways to enter the task and to show competence. (Lotan, 2003)

Make connections between two or more representations. (Lesh, Post, & Behr, 1988)

Students build mathematical understanding by reflecting and communicating, so tasks must allow and encourage these processes. (Hiebert, et. al., 1997)

Tasks must allow the students to treat situations as problematic, as something they need to think about rather than as a prescription they need to follow. (Hiebert, et. al., 1997)

What is problematic about the task should be the mathematics rather than other aspects of the situation. (Hiebert, et. al., 1997)

For students to work seriously on the task, it must offer students the chance to use skills and knowledge they already possess. (Hiebert, et. al., 1997)

Leave behind something of mathematical value…this means that when selecting tasks or problems, we need to think ahead of about the kinds of relationships that students might take with them from the experiences. (Hiebert, et. al., 1997)

Exposes what students know and provides information for next steps.

Accessible to a wide range of learners. (Piggott, 2012)

Offer different levels of challenge, but at whatever the learner's level there is a real challenge involved and thus there is also the potential to extend those who need and demand more. (Piggott, 2012)

Allow for learners to pose their own problems. (Piggott, 2012)

Encourage creativity and imaginative application of knowledge. (Piggott, 2012)

Have the potential for revealing patterns or lead to generalizations or unexpected results. (Piggott, 2012)

Encourage collaboration and discussion. (Piggott, 2012)

Must elicit problem-solving strategies. (Bornemann, Haury, & Slavit, 2009)

Support group work by eliciting conversation and thinking. (Bornemann, Haury, & Slavit, 2009)

How I (we) define Rich, Worthwhile Mathematical Tasks: