A. Common Features of NSF–sponsored Curricula

1. The curricula are organized using multiple strands of algebraic, geometric, statistical, probabilistic, numerical and discrete mathematical ideas, which build upon each other throughout each grade level;

2. Core mathematical ideas within each strand are carefully sequenced and articulated with each other through more advanced grades;

3. These core ideas are conceptual integrated and presented in the form of thematic units or content strands designed to intrigue and engage students at different levels of depth and abstraction;

4. The curricula use modeling, group data collection, simulations and predictions;

5. Students work individually and in collaborative learning groups to actively investigate non-routine problems over an extended period of time;

6. Graphics and scientific calculators are used as an integral component of the lessons;

7. The curricula are college-preparatory material accessible to all students.

These design features of the above NSF-sponsored curricula, accompanied by student-centered teaching methods, are supported by a substantial body of cognitive science research (Bruer, 1993; Caine, R., & Caine, G. 1991; Piaget, 1971). These curricula presuppose students are inherently "active learners" who interpret and construct meaning from their engagement with interesting mathematical questions and concrete materials. In these curricula, a series of carefully sequenced activities lead students to discover relationships and, therefore, acquire deeper conceptual understanding of

important mathematical ideas. Students work in small groups and collaborate on developing strategies to solve open-ended problems. Teachers guide the groups through "organized discovery" whereby the teacher asks a probing question provoking students to think rather than memorize. Students generate a variety of algorithms and are assessed using a variety of measures.

The internal organization of these new curricula is in sharp contrast to pre-standards texts, which organize and present mathematics formally, topic-by-topic, emphasizing algorithmic manipulations and computational tasks. A mathematics curriculum organized linearly by topic encourages an instructional method whereby the teacher stands and tells concepts and procedures to students, interspersed with teacher-led whole class questioning. Students in these classes typically sit passively in rows watching and listening as the teacher shows them a procedure on how to solve a particular problem. Students are then assigned homework problems to practice the day's new procedure and are later tested for mastery of the algorithms. The teacher then moves on to the next topic in an effort to "cover" the material. As a result, according to the *Third International Mathematics & Science Study (TIMSS)* (1997), the U.S. curriculum has become "a mile wide and an inch deep."