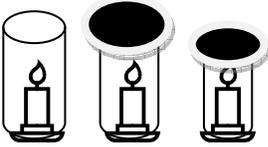| SCIMATH MN	SciMathMN *E–formation Information Update*
www.scimathmn.org	Vol. 1 No.2 ● March 2008

Two International Assessments: TIMSS and PISA
Similarities and Differences and What They Tell About Student Achievement in Mathematics and Science

	TIMSS Trends in Mathematics and Science Study	PISA Program for International Student Assessment
Sponsor	**International Association for the Evaluation of Educational Achievement (IEA)**	**Organization for Economic Cooperation and Development (OECD)**
Students Tested	**4th and 8th grade students** in **mathematics and science** (IEA does a separate reading literacy assessment known as PIRLS) Samples of students are tested in each country reflective of the entire student population of the country	**15-year olds** in **reading, mathematical and scientific literacy** Samples of students are tested in each country reflective of the entire student population of the country
Frequency of Testing	Since 1995, tests both mathematics and science on a **4-year cycle** 2007 test results to be announced December, 2008.	Since 2000 tests reading, mathematical and science literacy on a **3-year cycle** rotating one of the literacy areas to be tested in more depth each administration Math results announced 2004 and Science results 2007.
Purpose	**WHAT DID STUDENTS LEARN?** Purpose is to measure the skills and understandings that are typically taught in the curricula of participating countries to determine the level of student proficiency in learning what is taught.	**WHAT CAN STUDENTS DO AS A RESULT OF THEIR LEARNING?** Purpose is to measure the "yield" of educational systems; what skills and competencies have students acquired that allow them to *apply* their learning to solve problems presented in real-world contexts?
Participating Countries	**Industrialized countries** and those with **middle-income or emerging economies** TIMSS 2007 had 66 countries and Minnesota and Massachusetts participate	**30 OECD countries and 27 partnering countries representing 90% of the world's economy**
State Testing	Offers states an opportunity to participate as mini-nations	Not available
Who	Items chosen to assess the **topics, skills**	Items chosen from **larger, overarching**

determines what is assessed?	**and processes** that are collaboratively determined by content experts, education professionals and measurement specialists from many different countries. Follows traditional subject areas of mathematics and science, e.g. geometry, algebra, biology, chemistry	**ideas or themes** (e.g. biodiversity, science in health or uncertainty) with emphasis on contexts where mathematics and science are used; ideas and themes determined collaboratively among participating countries; draws from both school curricula and from learning outside of school
Types of Items on Test	**Majority are multiple choice items;** some short answer and constructed response or open-ended items (students are given a problem in a situation and asked to solve it and explain their solution) More focus on number, algebra and geometry; includes some data and reasoning. Surveys for students and educators about curriculum, instruction, teacher preparation, use of technology	**Majority are constructed response or open-ended items** (students are given a problem in a situation and asked to solve it and explain their solution); includes some multiple choice items More focus on the area of data; includes algebra and geometry

Sample Mathematics Item	**Grade 4**
	Here is a pattern.
	
	100, 1, 99, 2, 98, , ,
	
	What three numbers should go in the boxes?
	    a. 3, 97, 4
	    b. 4, 87, 5
	    c. 97, 3, 96
	    d. 97, 4, 96
		15-year olds
		You are asked to design a new set of coins. All coins will be circular and coloured silver, but of different diameters.
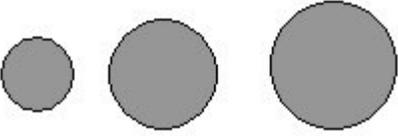		
		Researchers have found out that an ideal coin system meets the following requirements:

Sample Mathematics Item	**Grade 8**
	If n is a negative integer, which of these is the largest number?
	
	    a. $3 + n$
	    b. $3 \times n$
	    c. $3 - n$
	    d. $3 \div n$
		· diameters of coins should not be smaller than 15 mm and not be larger than 45 mm.
		· given a coin, the diameter of the next coin must be at least 30% larger.
		· the minting machinery can only produce coins with diameters of a whole number of millimetres (e.g. 17 mm is allowed, 17.3 mm is not).
		Design a set of coins that satisfy the above requirements. You should start with a 15 mm coin and your set should contain as many coins as possible.

Sample Science Item	**Grade 4** Which of these types of plants are usually found growing in a rain forest? *Students choose from:* a. Picture of evergreen trees b. Picture of palms and rainforest vegetation c. Picture of cacti d. Picture of deciduous trees	**15-year olds** Ray's bus (referred to in a previous item) is, like most buses, powered by a petrol engine. These buses contribute to environmental pollution. Some cities have trolley buses: they are powered by an electric engine. The voltage needed for such an electric engine is provided by overhead lines (like electric trains). The electricity is supplied by a power station using fossil fuels.
Sample Science Item	**Grade 8** **X Y Z** Three identical candles are placed in the three jars shown above and lit at the same time. Jars Y and Z are then sealed with lids and Jar X is left open. Which candle flame will go our first (X, Y, Z)? Explain your answer.	Supporters for the use of trolley buses in a city say that these buses don't contribute to environmental pollution. Are these supporters right? Explain your answer.
Connections to Additional Research Studies	Has generated several in-depth studies from the achievement and survey data , e.g. Stigler's video studies from '95 TIMSS video clip data on teaching differences in 3 countries; Schmidt's *Mathematics Teaching in the 21st Century* (MT@21) – a report on differences in middle school teacher preparation and its effect on student achievement among 6 countries	
References used or for further information: TIMSS: http://isc.bc.edu and http://nces.ed.gov/timss PISA: http://www.pisa.oecd.org and http://nces.ed.gov/surveys/pisa National Center for Education Statistics, *Comparing NAEP, TIMSS, and PISA in Mathematics and Science.* http://nces.ed.gov Schleicher, Andreas. *Science Competencies for Tomorrow's World.* http://all4ed.org/events/losingedge		