



TIMSS

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ASSESSMENT ITEMS

In developing **assessment items**

- Different mathematical activities
- Different conceptual structures

TIMSS (Trends in International Mathematics and Science Study)

(Mullis et al, 2003)

	Number	Algebra	Measurement	Geometry	Data
Knowing facts and procedures			Content domain		
Using concepts					
Solving routine problems	Cognitive domain				
Reasoning					

1. Knowing facts and procedures

- **Recall** definitions; properties; conventions
(e.g., $a + a + a = 3a$, $a \times a \times a = a^3$)
- **Recognize/identify** mathematical entities that are mathematical equivalent
(e.g., simplified algebraic expressions, differently oriented simple geometric figures)
- **Compute** algorithmic procedures
(e.g., simplify, factor, expand algebraic expressions)
- **Use tools** such as mathematics and measuring instruments
(Drawing, construction, reading scales)

2. Using concepts

- **Know** concepts such as inclusion, representation, and proof

example: Know that if five successive tosses of a fair coin come up "heads," the outcome of the next toss is as likely to be "tails" as "heads."

- **Classify**/group objects, shapes, numbers, expressions, and ideas according to common properties

example: Group pairs of quantities (lengths, weights, costs, etc.) in which the first quantity is greater than the second quantity.

2. Using concepts

- **Represent** numbers or mathematical information using models
(e.g., given a function rule, ordered pairs)
- **Formulate** problems or situations by equations or expressions ($4x + 3 = 51$)
(e.g., Four boxes are filled with golf balls, and 3 golf balls are left over. If there are 51 balls altogether, how many does each box hold?)

2. Using concepts

- **Distinguish** questions that can be addressed by given information from those that cannot (e.g., The weights of boys in a class are 1800kg. Answers to which of the following questions can be found?)
 1. What is the average weight of boys in the class?
 2. On average, do boys in the class weigh more than girls in the class?
 3. How many boys weigh more than 70 kg?
 4. What is the grade level of the class?

3. Solving routine problems

- **Select** an efficient method or strategy
(e.g., given a problem that can be modeled by a simple equation, select the appropriate equation.)
- **Model** an equation or diagram for problem solving
- **Interpret** given mathematical models
(e.g., given a set of expressions, which one can be the diagram be used to show?)

3. Solving routine problems

- **Apply** knowledge of facts, procedures, and concepts to solve routine (including real-life) problems (i.e., problems similar to those target students are likely to have encountered in class)
- **Verify/check** the correctness or reasonableness of the solution to a problem

example: Jack wants to find how far an airplane will travel in 3.5 hours at its top speed of 965 kph. He uses his calculator to multiply 3.5 by 965 and tells his friend Jenny that the answer is 33,775 km. Jenny says "that can't be right." How does she know?

4. Reasoning

- Make **conjectures** while investigating patterns

example: Twin primes are prime numbers with one other number between them. Thus, 5 and 7, 11 and 13, and 17 and 19 are pairs of twin primes. Make a conjecture about the numbers between twin primes.

- **Analyze** relationships between variables, objects, or data and make valid inferences
- **Evaluate** a mathematical idea, conjecture, proof, etc. (e.g., comment on a survey with obvious flaws (too small a sample, non-representative sample, etc.).

4. Reasoning

- **Generalize** the result of mathematical thinking

example: Given that the sum of the angles of a triangle is 2 right angles, and given diagrams of 4-, 5-, and 6-sided polygons divided into triangles, describe the relationship between the number of sides of any polygon and the sum of its angles in right angles.

- **Connect** new knowledge to existing one; make connections between different elements of knowledge and related representations; make linkages between related mathematical ideas or objects

Mullis et al.(2003) TIMSS Assessment Frameworks and Specifications 2003 2nd Edition

4. Reasoning

- **Synthesize** procedures to establish results (e.g., combine results obtained from two distinctive graphs to solve a problem)
- **Solve non-routine** problems in mathematical or real-life contexts

example: Given data and conditions in advertisements for competing products, select relevant data and find ways to make value comparisons valid in determining which product is most suitable in a particular context.

- **Justify/prove** statements

Mullis et al.(2003) TIMSS Assessment Frameworks and Specifications 2003 2nd Edition

For Mid-term Exam **on Oct. 21st**

- Please study all contents in the middle school constructed-response assessment data developed by city of Seoul and GyeongGi-Do
- Please study all contents in the high school constructed-response assessment data developed by city of Seoul and GyeongGi-Do

Each group and its choice

- Group 1: Connection
- Group 2: Connection
- Group 3: Reasoning and proof
- Group 4: Representation
- Group 5: Connection
- Group 6: Problem solving
- Group 7: Connection
- Group 8: Representation
- Group 9: Representation
- Group 10: Problem solving

References

- Mullis, I. V. S., Martin, M. O., Smith, T. A., Garden, R. A., Gregory, K. D., Gonzalez, E. J., Chrostowski, S. J., & O'connor, K. M. (2003). *TIMSS Assessment Frameworks and Specifications 2003 2nd Edition*. ISC: Boston College.