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Overview TIMSS 2019 Science Framework Grade 8

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Framework

The science assessment framework for TIMSS 2019 is organized around two dimensions:

- Content dimension, specifying the subject matter to be assessed
- Cognitive dimension, specifying the thinking processes to be assessed

Content Domains	Percentages
Biology	35%
Chemistry	20%
Physics	25%
Earth Science	20%

Cognitive Domains	Percentages
Knowing	35%
Applying	35%
Reasoning	30%

At the eighth grade, physics and chemistry are assessed as separate content domains and receive more emphasis than at fourth grade, where they are assessed as one content domain (physical science). The three cognitive domains (knowing, applying, and reasoning) are the same at both grades, encompassing the range of cognitive processes involved in learning science concepts, and then applying these concepts and reasoning with them.

In 2019, TIMSS Science also will assess science practices. These practices include skills from daily life and school studies that students use in a systematic way to conduct scientific inquiry and investigation and that are fundamental to all science disciplines.

Content Domains

Four major content domains define the science content for the TIMSS Science eighth grade assessment: biology, chemistry, physics, and Earth science.

Each of these content domains includes several major topic areas, and each topic area in turn includes one or more topics. Each topic is further described by specific objectives that represent the students' expected knowledge, abilities, and skills assessed within each topic. Across the eighth grade assessment, each objective receives approximately equal weight in terms of assessment items. The verbs used in the objectives are intended to represent typical performances expected of eighth grade students, but are not intended to limit performances to a particular cognitive domain. Each objective can be assessed drawing on each of the three cognitive domains (knowing, applying, and reasoning).

Biology

At the eighth grade, students build on the foundational life science knowledge they learned in the primary grades, and develop an understanding of many of the most important concepts in biology. The biology domain includes six topic areas:

- Characteristics and life processes of organisms
- Cells and their functions
- Life cycles, reproduction, and heredity
- Diversity, adaptation, and natural selection
- Ecosystems
- Human health

Concepts learned in each of these topic areas are essential for preparing students for more advanced study. Eighth grade students are expected to understand how structure relates to function in organisms. They also should have a foundational understanding of cell structure and function and the processes of photosynthesis and cellular respiration. At this level, the study of reproduction and heredity provides a foundation for later, more advanced study of molecular biology and molecular genetics. Learning the concepts of adaptation and natural selection provides a foundation for understanding evolution, and an understanding of processes and interactions in ecosystems is essential for students to begin to think about how to develop solutions to many environmental challenges. Finally, developing a science-based understanding of human health enables students to improve the condition of their lives and the lives of others.

Earth Science

Topics covered in the teaching and learning of Earth science draw on the fields of geology, astronomy, meteorology, hydrology, and oceanography, and are related to concepts in biology, chemistry, and physics. Although separate courses in Earth science covering all of these topics are not taught in all countries, it is expected that understandings related to Earth Science topic areas will have been included in a science curriculum covering the physical and life sciences or in separate courses such as geography and geology. The TIMSS 2019 Science Framework identifies the following topic areas that are universally considered to be important for students at the eighth grade to understand as they learn about the planet on which they live and its place in the universe:

- Earth's structure and physical features
- Earth's processes, cycles, and history
- Earth's resources, their use, and conservation
- Earth in the Solar System and the universe

Eighth grade students are expected to have some general knowledge about the structure and physical features of Earth, including Earth's structural layers, and the atmosphere. Students also should have a conceptual understanding of processes, cycles, and patterns, including geological processes that have occurred over Earth's history, the water cycle, and patterns of weather and climate. Students should demonstrate knowledge of Earth's resources and their use and conservation, and relate this knowledge to practical solutions to resource management issues. At this level, the study of Earth and the Solar System includes understanding how observable phenomena relate to the movements of Earth and the Moon, and describing the features of Earth, the Moon, and other planets.



Bibliography

Mullis, I. V. S., & Martin, M. O. (Eds.). (2017). *TIMSS 2019 Assessment Frameworks*. Retrieved from Boston College, TIMSS & PIRLS International Study Center website: <http://timssandpirls.bc.edu/timss2019/frameworks/>