United Nations Educational, Scientific and Cultural Organization

UNESCO INSTITUTE FOR STATISTICS

GLOBAL ALLIANCE TO MONITOR LEARNING

SUSTAINABLE DEVELOPMENT GOALS

Using TIMSS Science for the measurement of indicator 4.7.5

This document shortly describes the suggestion to include TIMSS Grade 8 data to measure progress towards the UN Sustainable Development Goal 4, Target 4.7.

While the IEA Civics and Citizenship Study (ICCS) will help in measuring thematic indicator 4.7.4: "Percentage of students by age group (or education level) showing adequate understanding of issues relating to global citizenship and sustainability", it should be put forward here that IEA's Trends in International Mathematics and Science Study (TIMSS) will help in measuring the thematic indicator 4.7.5. The topics to be covered in indicator 4.7.5 relate to the "Percentage of 15-year-old students showing proficiency in knowledge of environmental science and geoscience", areas that are partly covered by the TIMSS Grade 8 science framework.

TIMSS has been measuring trends in mathematics and science achievement at the fourth and eighth grades (and partly also the final grade of secondary education) since 1995. TIMSS assessments use the curriculum (broadly defined by using curricula of the participating countries as a common basis) as the major organizing concept in order to investigate how the participating countries are providing educational opportunities in mathematics and science to students. Additionally, TIMSS investigates in the factors related to how students are using these opportunities.

Currently 40 countries and 5 Benchmarking entities from all over the world are participating in Grade 8 of the actual TIMSS 2019 assessment. A similar number of countries participated in previous cycles of the assessment as can be seen from the table below:

Year	Number of countries (G8)
1995	46
1999	38
2003	47
2007	0
2011	42
2015	38

Hence, mathematics and science achievement scales and international proficiency levels are well established and widely recognized.

The current cycle of TIMSS is focusing on converting to a digital format allowing including additional practical tasks and experiments, such as a plant growth experiment, which can be used to more thoroughly assess students' knowledge in the curriculum areas covered by the TIMSS frameworks. The TIMSS science framework in grade 8th covers the content dimensions Biology, Chemistry, Physics, and Earth science covering a globally relevant perspective as the assessment framework is based on the national curricula of the participating countries. The science part of the TIMSS Grade 8 main assessments typically consists of about 225 items, with only a fraction administered to each of the students to avoid overburdening. Currently, 338 new (paper) science items are field trialed to test their suitability to replace the released item blocks in the 2019 main data collection.

For indicator 4.7.5 especially the content domains Biology and Earth Science are regarded as especially relevant. For all content sub-domains separate scale scores are calculated. Each of the content areas include several major topics that in turn are described by specific objectives. Objectives represent typical performances expected of the students and are assessed in three different cognitive domains (knowing, applying, and reasoning).

In Biology, especially two out of the six topic areas covered by the TIMSS science framework, namely the topics “Ecosystems”, and “Human health” will suit well to target indicator 4.7.5. Students here are assessed in terms of their understanding related to processes and interactions in ecosystems that is seen as essential for them to begin to think about how to develop solutions to many environmental challenges (P 40, FRAMEWORK). Furthermore, students should get a “science-based” understanding of human health” in order to improve the conditions of their lives and the lives of others” (p. 40). A more detailed description of the framework for the above-mentioned two topics can be found in Mullis & Martin (2017) on page 42-43.

In Earth science, out of the four topic areas covered in the TIMSS framework, especially data related to the topics “Earth’s resources, their use, and conservation” will be specifically relevant to the measurement of indicator 4.7.5. The objective here is that “Students should demonstrate knowledge of Earth’s resources and their use and conservation, and relate this knowledge to practical solutions to resource management issues.” (Mullis & Martin, 2017, p 44). Details on the topic also can be found on page 51 of the framework.

Attached documents:

- Summary of the TIMSS 2019 science framework with focus on Biology and Earth science (MS Word)
- Extract of the TIMSS 2019 Science Framework with focus on Biology and Earth science (PDF)
- Examples of released TIMSS 2015 items (PDF)

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/

UNESCO (2017). Unpacking Sustainable Development Goal 4 – Education 2030.