Proposal for a Measurement Strategy for Thematic Indicator 4.7.5 using International Large-Scale Assessments in Education

GAML6/WD/8

Introduction

Indicator 4.7.5, **Percentage of 15-year-old students showing proficiency in knowledge of environmental science and geoscience**, is one of the five thematic indicators for the target 4.7. It refers to learning outcomes that are achieved as a result of the educational inputs described in the global indicator 4.7.1 "Extent to which (i) global citizenship education and (ii) education for sustainable development, including gender equality and human rights, are mainstreamed at all levels in: (a) national education policies, (b) curricula, (c) teacher education and (d) student assessment."

This document is a concise summary of the current proposed measurement strategy for the indicator 4.7.5 using International Large-Scale Assessments (ILSAs).

Brief background

Previous measurement solutions were developed to address the challenge of monitoring indicators 4.7.1, 4.7.4, and 4.7.5 to propose a measurement strategy based on existing ILSAs in education. Therefore, in the development of a conceptual framework for a measurement strategy for Indicators 4.7.4 and 4.7.5, a global content framework was first defined, followed by a mapping exercise of the seven categories specified in the content framework. The global content framework consists of seven categories, which are also broken down in sub-categories: Interconnectedness and Global Citizenship, Gender Equality, Peace, Human Rights, Health and Well-being, Sustainable Development, and Environmental Science) (see Table 1).[1] The content framework was then evaluated to identify if the different concepts included could be measured with the instruments and procedures of existing ILSAs. Using the global content framework, the most recent versions of the frameworks and the instruments, or questionnaires, of TIMSS were assessed on the following criteria:

- The assessment framework should refer to the concepts relevant to SDG 4.7.5;
- The assessment should provide sufficient information on many of the categories and sub-categories involved;
- The instruments should potentially allow long-term monitoring.

Considering that all the categories of the content framework of Indicator 4.7.5 are covered by the contents of TIMSS, the most practical way of establishing a threshold for "an adequate understanding of issues relating to global citizenship and sustainability" is by finding this definition in current assessment frameworks.

Based on recent work, three core dimensions proposed by UNESCO to measure learning outcomes in Global Citizenship Education (GCED) were incorporated: cognitive, socio-emotional and behavioural (non-cognitive dimensions) (see Table 2). The proposal that follows is limited to the cognitive dimension.

A strategy for measuring Indicator 4.7.5 using TIMSS Grade 8 data was then endorsed on the last core framework at the fifth Meeting of the Technical Working Group (TCG) in Mexico City, Mexico on 15-16 November 2018.

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[1] The global content framework is presented in more detail in UIS (2019).

Global content framework for SDG thematic indicator 4.7.1, 4.7.4 and 4.7.5

Definition of GCED and ESD

The global indicator 4.7.1 measures the extent to which countries mainstream Global Citizenship Education (GCED) and Education for Sustainable Development (ESD); and the thematic indicators 4.7.4 and 4.7.5 refer to learning outcomes that should be achieved as a result of the educational inputs described in the global indicator. In this section, we first establish a definition of GCED and ESD that will constitute the base of a global content framework for the construction of specific indicators. GCED and ESD represent the higher order competences within Target 4.7, which outlines the knowledge, skills, attitudes and values of all learners to promote a sustainable future. Within target 4.7, these competences are associated with the values of sustainability, human rights, gender equality, peace and non-violence and appreciation of cultural diversity (Hoskins, 2016). Reaching consensus on a definition of these concepts is particularly difficult since they have distinct histories within UNESCO and beyond; and because they both are considered as umbrella concepts that encompass a broad range of knowledge, skills, attitudes, values, identities and behaviours.

UNESCO has conducted extensive work directed at defining and operationalizing GCED and ESD. A review of the literature on the topic suggests the following conclusions: a) there is currently neither a clear definition nor universal agreement in defining and operationalizing these concepts; b) however, a set of guiding principles and themes within GCED and ESD can be identified.

For the purpose of the current exercise, we build on previous work conducted by UNESCO and partially adopt the definitions and operationalization advanced in recent documents (e.g. Hoskins, 2016; IBE, 2016; Sandoval-Hernández & Miranda, 2018; UIS, 2017; UNESCO, 2012a, 2012b, 2013, 2014, 2015). So, drawing on this body of literature we propose the following working definitions of GCED and ESD:

Global Citizenship Education (GCED): nurtures respect for all, building a sense of belonging to a common humanity and helping learners become responsible and active global citizens. GCED aims to empower learners to assume active roles to face and resolve global challenges and to become proactive contributors to a more peaceful, tolerant, and inclusive and secure world.

Education for Sustainable Development (ESD): empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability and a just society, for present and future generations, while respecting cultural diversity. It is about lifelong learning, and is an integral part of quality education.

Operationalization

Our operationalization of these concepts is based on the work of a research team from the International Bureau of Education (IBE) and the Global Education Monitoring Report (GEMR) team that developed a coding scheme (IBE, 2016) to evaluate 78 national curricula for evidence of GCED and ESD content. Table 1 presents the global content framework that will be used in this exercise. As mentioned above, it is based on the coding scheme developed by the IBE and GEMR team but has the following adaptations. This coding scheme was specially designed to measure the global indicator 4.7.1 (i.e. the extent to which countries mainstream GCED and ESD).

Table 1. Global Content Framework for SDG indicators 4.71, 4.7.4 and 4.7.5

	Category	Sub-category
Global Citizenship Education (GCED)	Interconnectedness and Global Citizenship	Globalization
		Global/international citizen(ship), global culture/identity/community
		Global-local thinking, local-global, think global act local, glocal
		Multicultural(ism)/intercultural(ism)
		Migration, immigration, mobility, movement for people
		Global competition/competitiveness/globally competitive/international competitiveness
		Global inequalities/disparities
	Gender Equality	Gender equality/equality/parity
		Empower(ment of) women/girls (female empowerment, encouraging female participation)
	Peace, Non-violence and Human Security	Peace, peace-building
		Awareness of forms of abuse/harassment/violence (school-based violence/bullying, household-based violence, gender-based violence, child abuse/harassment, sexual abuse/harassment)
Education for Sustainable Development (ESD)	Human Rights	Human rights, rights and responsibilities (children's rights, cultural rights, indigenous rights, women's rights, disability rights)
		Freedom (of expression, of speech, of press, of association/organisation), civil liberties
		Social justice
		Democracy/democratic rule, democratic values/principles
	Health and Well-being	Physical health/activity/fitness
		Mental, emotional health, psychological health
		Healthy lifestyle (nutrition, diet, cleanliness, hygiene, sanitation, *clean water, being/staying healthy)
		Awareness of addictions (smoking, drugs, alcohol)
		Sexual and/or reproductive health
	Sustainable Development	Economic sustainability, sustainable growth, sustainable production/consumption, green economy
		Social sustainability (social cohesion re sustainability)
		Environmental sustainability/environmentally sustainable
		Climate change (global warming, carbon emissions/footprint)
		Renewable energy, alternative energy (sources) (solar, tidal, wind, wave, geothermal, biomass…)
		Ecology, ecological sustainability (ecosystems, biodiversity, biosphere, ecology, loss of diversity)
		Waste management, recycling
	Environmental Science (geoscience)	Physical systems
		Living systems
		Earth and space systems

One adaptation was the elimination of some of the sub-categories originally included in the coding scheme. Some concepts (e.g. Human Rights or Peace) had two sub-categories each. One referring to the concept itself and another referring to the educational contents (e.g. Human Rights and Human Rights Education). These double entries were eliminated (cf. IBE (2016), pp 38-39).

Mapping exercise for SDG global indicator 4.7.5

> *4.7.5 Percentage of 15-year-old students showing proficiency in knowledge of environmental science and geoscience.*

In order to carry out the mapping of this indicator we used the following analytical strategy:

First, informed by the content framework presented in the previous section (see UIS (2019) for more details), we consulted the latest version of the frameworks and the instruments/questionnaires applied by two ILSAs of student outcomes. We particularly focused on studies and instruments that could potentially provide information about attained curriculum (e.g. by means of student assessment). These were the OECD Programme for International Student Assessment (PISA)[2] and the IEA Trends in International Mathematics and Science Study (TIMSS).[3] We assessed these sources of information with the following criteria in mind: the assessment framework should refer to the concepts relevant to SDG 4.7.5, the instrument should provide sufficient information on many of the categories and sub-categories involved, and they should potentially allow long-term monitoring.

As a result of this exercise, we identified the TIMSS as the most convenient source of information for the global indicator SDG 4.7.5. Both ILSAs contain information for the main category and all the sub-categories considered for this indicator, however, TIMSS offers better conditions for long-term monitoring. In each round of PISA, only one of the core domains is tested in detail (i.e. reading, mathematics or science). The last round in which science was the major domain was 2015, the previous one was in 2006, and the next one will be 2024. Therefore, when using PISA, the trends for this indicator could only be calculated every nine years. In contrast, TIMSS is applied every four years since 1999, offering the potential of calculating trends over a period of 24 years.

Second, we reviewed the instruments and items that could be relevant for SDG 4.7.5 (Foy, 2017; Mullins & Martin, 2017) to identify the contents of this study that can be used to measure the corresponding categories and sub-categories from out content framework. Drawing on UNESCO's model of global competences (UNESCO, 2015) and in order to keep consistency with the mapping exercise carried out for 4.7.4, we decided to incorporate the same three core dimensions to measure learning outcomes than those propose for the GCE. The core dimensions are the same as for 4.7.4 but we adapted the descriptions for them to fit the purpose of measuring learning outcomes in Environmental science. The core dimensions and their descriptions are presented below, each indicating the domain of learning they focus on most of the learning process:

Table 12 in UIS (2019) provides an overview of our mapping exercise assuming an *attained* curriculum perspective.

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[2] See: http://www.oecd.org/pisa/
[3] See: https://www.iea.nl/studies/iea/timss

Table 2. Core conceptual dimensions of global citizenship education

Cognitive:
To acquire knowledge, understanding and critical thinking about global, regional, national and local issues and the interconnectedness and interdependency of different countries and populations
Non-cognitive:
Socio-emotional:
To have a sense of belonging to a common humanity, sharing values and responsibilities, empathy, solidary and respect for differences and diversity.
Behavioural:
To act effectively and responsibly at local, national and global levels for a more peaceful and sustainable world.

Proposal for minimum proficiency levels

In the cognitive dimension, the specific level or benchmark to be considered to reflect "proficiency" as Indicator 4.7.5 corresponds to[4]:

Students have basic knowledge and understanding of practical situations in the sciences. Students recognize some basic information related to characteristics of living things, their reproduction and life cycles, and their interactions with the environment, and show some understanding of human biology and health. They also show some knowledge of properties of matter and light, electricity and energy, and forces and motion. Students know some basic facts about solar system and show an initial understanding of Earth's physical characteristics and resources. They demonstrate ability to interpret information in pictorial diagrams and apply factual knowledge to practical situations.

Data access for indicator production

The review of ILSAs to produce indicator for 4.7.5 shows that information from TIMSS is the most comprehensive source of information for all six categories of the Global Content Framework. However, the access to information required to report on the two dimensions, cognitive and non-cognitive, there are property implications important to consider.

For the cognitive dimension, the information required from IEA's TIMSS to process the items which map to the content framework is not publicly available. Therefore, two options are possible: IEA agrees to grant UIS with the access to items identified to proceed with the estimations, or IEA processes the identified non-public items internally and then shares the outputs with UIS. In both cases, an active involvement from IEA is required to solve the challenges associated with IEA's property rights.

For the non-cognitive dimension, the context-related items identified are publically available. The production of indicators is therefore a matter of selecting and processing the items from freely available questionnaires based on the proposed methodology in UIS (2019).

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[4] The proposed benchmark corresponds to the TIMSS Intermediate International Benchmark established by IEA.

Next steps

1. To map other ILSA such as PISA for example.

2. To map existing national assessment to define the possibility of using them provided their content includes could be aligned with the verbal definition proposed.

3. To negotiate with IEA and OECD the reporting for indicator 4.7.5 to the extent possible based on the existing data.

4. To estimate the non-cognitive dimension based on publicly available data and requests country's approval for their publication.

References

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Annex 1

Table A.1 Synthesis Matrix for SDG Indicators 4.7.1, 4.7.4 and 4.7.5

	4.7.1	4.7.4	4.7.5
Global content framework	Resting on the definitions of the Global Citizenship Education (GCED) and Education for Sustainable Education (ESD), the Global content framework is composed of 7 main categories, which are also broken down in sub-categories: • Interconnectedness and Global Citizenship • Gender Equality • Peace • Human Rights • Health and Well-being • Sustainable Development • Environmental Science (geoscience)		Framework was endorsed during the 5th TCG meeting in Mexico City on 15-16 November 2018
Conceptual dimensions: Policy	Measured using national education educational policies, curricula, teacher education, and student assessment, based on a series of dichotomous items.	N/A	
Cognitive	N/A	Measured using items from ILSAs. However, the selected items, from IEA, are not public domain – an agreement is needed to process the data.	
Non-cognitive	N/A	Measured using items from ILSAs, which are public domain.	
Data availability	Yes	**Cognitive dimension:** - Yes but not public - Need processing **Non-cognitive dimension:** - Yes - Need processing	**Cognitive dimension:** - Yes but not public - Need processing **Non-cognitive dimension:** - Yes - Need processing