



# A Measurement Strategy for SDG Thematic Indicators 4.7.4 and 4.7.5 Using International Large Scale Assessments in Education

June 2020

## Executive Summary

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In this report, we use data from ICCS, TIMSS and PISA to estimate the proportion of students who reach the targets set by SDG thematic indicators 4.7.4 and 4.7.5 for each country and region with available data. In what follows, we briefly describe our analytical strategy, the description of the content and types of cognitive processing skills and strategies demonstrated by students at the cut-off points estimated for each target, and present summary tables with the proportion of students who reach each of the specified targets in each country or region.

### Analytical strategy

The analytical strategy included five main steps: verify the availability of observed responses to the items proposed by the mapping exercise described above (Sandoval-Hernández et al., 2019), test the unidimensionality of the intended constructs, fit the corresponding measurement models to obtain scores for each target, estimate the cut-off points to identify the students who reach each of the targets evaluated.

To obtain the scores, we use a latent variable model approach. More specifically, we use a partial credit model (Masters, 2016).<sup>1</sup> Formally, this model can be described as follows (see Wu et al., 2016):

(1)

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<sup>1</sup> The exception is Indicator 4.7.4, subcategory 'Freedom', for which we used a series of latent class analysis. See the main report for details.

$$Pr(Y_{ip} = j|\theta_p) = \frac{\exp \sum_{k=0}^j (\theta_p - \delta_{ik})}{\sum_{h=0}^{m_i} \exp \sum_{k=0}^h (\theta_p - \delta_{ik})}$$

The proportion of students reaching the targets within each country or region is then calculated as a simple proportion.

$$P = \frac{X}{n} \quad (2)$$

We also estimate the proportion of students that meet any of the standards stipulated by Indicators 4.7.5 and 4.7.4, for each country and region for which data is available. To this end, we use a mean score that summarizes all the standards that a student has met. This mean score varies from 0 to 1, where the maximum is achievable by a student if and only if, this student has met all the standards where he or she was classified. Zero is assigned if a student has not met any of the proposed standards. Likewise, if a student satisfies two out of three, then he or she is attributed a score of .66 (2/3). This calculation is expressed in the next equation:

$$\bar{D}_i = \frac{\sum_i^{n_D} D_i}{n_D} \quad (3)$$

## Description of cut-off points

### 4.7.4 – Percentage of students by age group (or education level) showing an adequate understanding of issues relating to global citizenship and sustainability.

#### COGNITIVE

This section is pending until we receive the classification of the test items from the IEA

#### NON-COGNITIVE

##### *Interconnectedness and Global Citizenship*

This category is measured through two sub-categories: 'Global-local thinking' and 'Multicultural(ism)/intercultural(ism)'.

##### *Global-local thinking*

**At the threshold, students have more than 50% chances to express positives attitudes towards their country of residence.** Most of the students at or above the cut-off score agree a lot to expressions such as "I am proud to live in <country of test>.", "In <country of test> we should be proud of what we have achieved", or "I have great respect for <country of test>."

##### *Multicultural(ism)/intercultural(ism)*

**At the threshold, students have more than 50% chances to express positives attitudes towards ethnic/racial minorities.** Most of the students at or above the cut-off score agree a lot to expressions such as "<Members of all ethnic/racial groups> should be encouraged to run in elections for political office", "<Members of all ethnic/racial groups> should have equal access to education", or "<Members of all ethnic/racial groups> should have equal chances to get a good job in <country of test>."

##### *Gender Equality*

**At the threshold, students have more than 50% chances to strongly endorse gender equality.** Most of the students at or above the cut-off score agree a lot to expressions such as "Men and women should have equal opportunities to take part in government" or "Men and women should get equal pay when they are doing the same jobs". Complementary, most of the students at or above the cut-off score express strong disagreement to expressions such as "Women should stay out of politics" or "Men are better qualified to be political leaders than women".

##### *Peace, Non-violence and Human Security*

**At the threshold, students have more than 50% chances of reporting not experiencing bullying.** Most of the students at or above the cut-off score report not having experienced at all situations such as "being called by an offensive nickname", "being threatened to be hurt", or "other students posting offensive pictures or texts about them".

##### *Human Rights*

This category is measured through two sub-categories: 'Freedom (of expression, of speech, of press, of association/organisation)' and 'Social Justice'.

##### *Freedom (of expression, of speech, of press, of association/organisation)*

**At the threshold, students have more than 50% chances of identifying situations that are deemed good for democracy, as well as those situations that are deemed bad for democracy.** Most of the students at or above the cut-off score consider that situations like "People are allowed to publicly

criticise the government” or “All adult citizens have the right to elect their political leaders” are good for democracy. Complementary, most of the students at or above the cut-off score consider that situations like “Political leaders give government jobs to their family members” or “One company or the government owns all newspapers in the country” are bad for democracy.

Social Justice

**At the threshold, students have more than 50% chances to highly endorse the importance of social participation in social movements.** Most of the students at or above the cut-off score consider that behaviours such as “Participating in protests against laws believed to be unjust”, “Participating in activities to benefit people in the local community” or “Taking part in activities to protect the environment” are very important for being a good citizen.

*Sustainable Development*

**At the threshold, students have more than 50% chances of identifying threats to the world’s future and reporting that they would definitely make personal efforts to avoid them.** Most of the students at or above the cut-off score consider that, to a large extent, issues like “Pollution”, “global financial crisis”, “Violent conflicts” or “climate change” are a threat to the world’s future; and that they would certainly make personal efforts to help the environment.

#### 4.7.5 – Percentage of 15-year-old students showing proficiency in knowledge of environmental science and geoscience

COGNITIVE

**At the threshold, students apply and communicate their understanding of concepts from environmental science and geoscience in everyday and abstract situations.** They communicate their understanding of ecosystems and the interaction of organisms with their environment and apply some knowledge of human health related to nutrition and infectious disease. Students show some knowledge and understanding of the composition and properties of matter and chemical change. They apply knowledge of Earth’s physical features, processes, cycles, and history, and show some understanding of Earth’s resources, their use, and conservation as well as some knowledge of the interaction between the Earth and the Moon.

NON-COGNITIVE

*Enjoy environmental science and geoscience*

**At the threshold, students have more than 50% chances to express high enjoyment of learning environmental science and geoscience.** Most of the students at or above the cut-off score agree a lot to expressions such as “I like to conduct science experiments”, “I learn many interesting things in science” or “I like Science”. Complementary, most of the students at or above the cut-off score express disagreement to expressions such as “Science is boring” or “I wish I did not have to study science”.

*Confidence in environmental science and geoscience*

**At the threshold, students have more than 50% chances to report high confidence in learning environmental science and geoscience.** Most of the students at or above the cut-off score highly disagree with the statement “Science makes me confused”, and express agreement to statements such as “I learn things quickly in science”, “I usually do well in science”, or “I’m good to work out difficult science problems”.

## Summary Table

Table 1A. Percentage of students reaching the targets of Indicator 4.7.5

Country	Cognitive	Non-Cognitive		Global %
		Enjoyment	Confidence	
Abu Dhabi, UAE	0.19	0.33	0.29	0.27
Armenia	0.24			
Australia	0.34	0.24	0.21	0.26
Bahrain	0.21	0.37	0.32	0.3
Botswana	0.07	0.51	0.18	0.25
Buenos Aires, Argentina	0.13	0.18	0.22	0.18
Canada	0.39	0.29	0.29	0.32
Chile	0.18	0.25	0.19	0.21
Chinese Taipei	0.55	0.16	0.11	0.27
Dubai, UAE	0.36	0.44	0.38	0.4
Egypt	0.06	0.44	0.31	0.27
England	0.39	0.28	0.25	0.31
Georgia	0.13			
Hong Kong, SAR	0.45	0.26	0.16	0.29
Hungary	0.38			
Iran, Islamic Rep. of	0.18	0.43	0.36	0.32
Ireland	0.39	0.28	0.3	0.33
Israel	0.34	0.25	0.37	0.32
Italy	0.31	0.24	0.31	0.28
Japan	0.49	0.13	0.07	0.23
Jordan	0.11	0.49	0.34	0.31
Kazakhstan	0.37			
Korea, Rep. of	0.45	0.09	0.09	0.21
Kuwait	0.12	0.43	0.39	0.32
Lebanon	0.1			
Lithuania	0.35			
Malaysia	0.21	0.46	0.07	0.25
Malta	0.24			
Morocco	0.07			
New Zealand	0.36	0.27	0.19	0.27
Norway	0.33	0.24	0.34	0.32
Oman	0.17	0.45	0.36	0.33
Ontario, Canada	0.37	0.3	0.29	0.32
Qatar	0.2	0.34	0.31	0.29
Quebec, Canada	0.42	0.25	0.29	0.32
Russian Federation	0.45			
Saudi Arabia	0.07	0.37	0.31	0.25
Singapore	0.59	0.34	0.2	0.38
Slovenia	0.5			
South Africa	0.05	0.41	0.25	0.24
Sweden	0.41			
Thailand	0.16	0.31	0.09	0.19
Turkey	0.25	0.46	0.37	0.36
United Arab Emirates	0.24	0.37	0.32	0.31
United States	0.4	0.32	0.35	0.36

Table 2A. Table 1A. Percentage of students reaching the targets of Indicator 4.7.4

Country	Cognitive	Non-Cognitive							Global %
		Global-local	Multiculturalism	Gender equality	Peace	Freedom	Social justice	Sustainable dev.	
Belgium (Flemish)		0.35	0.13	0.62	0.45	0.39	0.58	0.39	0.41
Bulgaria		0.71	0.12	0.26	0.42	0.42	0.8	0.52	0.46
Chile		0.64	0.44	0.52	0.44	0.34	0.71	0.71	0.55
Chinese Taipei		0.52	0.45	0.69	0.59	0.77	0.74	0.5	0.61
Colombia		0.76	0.22	0.41	0.37	0.11	0.84	0.73	0.49
Croatia		0.68	0.17	0.58	0.33	0.6	0.78	0.53	0.52
Denmark		0.38	0.2	0.71	0.47	0.56	0.39	0.29	0.43
Dominican Republic		0.87	0.22	0.16	0.37	0.03	0.87	0.48	0.42
Estonia		0.49	0.21	0.47	0.41	0.52	0.57	0.36	0.43
Finland		0.53	0.26	0.63	0.53	0.61	0.53	0.32	0.49
Hong Kong SAR		0.22	0.39	0.45	0.36	0.51	0.66	0.56	0.45
Italy		0.45	0.15	0.59	0.49	0.47	0.79	0.55	0.5
Korea, Republic of		0.53	0.41	0.55	0.59	0.47	0.79	0.49	0.55
Latvia		0.52	0.09	0.25	0.44	0.4	0.57	0.46	0.39
Lithuania		0.54	0.21	0.37	0.38	0.42	0.62	0.61	0.45
Malta		0.57	0.18	0.57	0.36	0.25	0.65	0.44	0.43
Mexico		0.66	0.27	0.17	0.36	0.11	0.81	0.63	0.43
Netherlands		0.3	0.13	0.53	0.55	0.54	0.4	0.21	0.38
North Rhine-Westphalia		0.29	0.25	0.67	0.49	0.61	0.58	0.27	0.45
Norway		0.61	0.38	0.72	0.42	0.3	0.66	0.31	0.49
Peru		0.79	0.21	0.36	0.36	0.09	0.81	0.44	0.43
Russian Federation		0.63	0.24	0.16	0.45	0.41	0.65	0.44	0.42
Slovenia		0.48	0.16	0.56	0.39	0.54	0.63	0.55	0.47
Sweden		0.33	0.5	0.74	0.48	0.51	0.65	0.31	0.5