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Measurement Strategy for SDG Global Indicator 4.7.1 and Thematic Indicators 4.7.4 and 4.7.5 using International Large- Scale Assessments in Education

Proposal

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Abstract

The aim of this document is to support the development of a measurement strategy for SDG Global Indicator 4.7.1 and Thematic Indicators 4.7.4 and 4.7.5 using International Large-Scale Assessments (ILSAs) in Education. In order to do that, the study identifies a global content framework for the three indicators based on the existing mapping exercises. Then, it evaluates the extent to which the different concepts contained in the content framework can be measured with the instruments and procedures of existing ILSAs. Finally, the document presents a proposal to define proficiency levels for each of the indicators based on definitions from the same ILSAs; and concludes with an overview of the three sections described above, its limitations and suggestions for developing a measurement strategy for the three indicators.

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Introduction

The Sustainable Development Goals (SDGs) are the blueprint to achieve a better and more sustainable future for all. They address the most important global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice. Within these goals, SDG4 establishes that by 2030 we have to “Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all”. SDG4 contains 10 specific targets. One of these targets, 4.7, refers to the knowledge and skills that are necessary for a sustainable future. Specifically, it states that by 2030, we have to “[...] ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture’s contribution to sustainable development”.

The current global indicator for target 4.7 is: “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”.

Apart from its global indicator, target 4.7 includes five thematic indicators:

4.7.2 Percentage of schools that provide life skills-based HIV and sexuality education.

4.7.3 Extent to which the framework on the World Programme on Human Rights Education is implemented nationally (as per the UNGA Resolution 59/113).

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

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

As mentioned above, this document focuses on the global indicator (4.7.1) and the last two thematic indicators (4.7.4 and 4.7.5). These two thematic indicators refer to learning outcomes that are achieved as a result of the educational inputs described in the global indicator. This document builds on previous measurement solutions developed to address the challenge of monitoring these three indicators to propose a measurement strategy based on existing international large-scale assessments (ILSAs) in education. In fact, it is important to notice that, according to the measurement strategy for SDG target 4.7 proposed by GALM and the Task Force 4.7 (UIS, 2017), the two thematic indicators were originally inspired by the IEA’s International Civic and Citizenship Study (ICCS) and the OECD’s Programme for International Student Assessment (PISA).

Apart from this introduction, this document is divided into four sections. The first section is dedicated to identifying a global content framework for the three indicators based on the existing mapping exercises. In the second section, we evaluate the extent to which the different concepts included in the content framework can be measured with the instruments and procedures of existing ILSAs. The third section contains a proposal to define proficiency levels for each of the indicators based on definitions from the same ILSAs. Finally, the last section is dedicated to the discussion and conclusions.

A. Global content framework for SDG thematic indicators 4.7.1, 4.7.4 and 4.7.5

A.1 Concepts

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 in 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.

A.2 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. The exercise involved several pilots, parallel coding with different coders coding the same documents, and resulted in a scheme with six categories in the knowledge dimension (see **Table 1**): Human Rights; Gender Equality; Peace, Non-violence and Human Security; Health and Well-being; Sustainable Development and Interconnectedness and Global Citizenship.

Based on UNESCO's recommendations (UNESCO, 2012a, 2012b, 2013, 2014, 2015), each of the six categories was further divided into sub-categories. These sub-categories provide more information, such as how the main categories are to be understood, and which aspects are included in the curriculum. In section B, these categories and sub-categories are mapped into the instruments of existing ILSAs to evaluate the extent to which this content framework can be measured with them.

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). For this reason, it does not necessarily map into all the concepts contained in the thematic indicators 4.7.4 and 4.7.5 that refer to the learning outcomes to be achieved by the students. For example, while environmental science and geoscience (indicator 7.4.5) overlap to some extent with ESD, they are not explicitly considered in the coding scheme. Therefore, we added a category and a set of sub-categories to include these concepts in our global content framework. Because the indicator 7.4.5 was originally inspired by the concept of environmental science included in PISA 2006 (UIS, 2017), these categories and sub-categories are based on the assessment framework of this cycle of PISA (OECD, 2009). The concepts of environmental science and geoscience were collapsed in the same category because, according to the PISA framework (OECD, 2009), geoscience is a component of environmental science and it was not possible to distinguish the sub-categories for both concepts.

Another 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).

In order to make it possible to map these categories and sub-categories into the ILSAs instruments associated to the global indicator 4.7.1 (see section B), it was necessary to define not only GCED and ESD but also what is going to be understood by national education policies, curricula, teacher education and student assessment. The definitions and their operationalization were guided by the UNESCO's recommendations (UNESCO, 2012a, 2012b, 2013, 2014, 2015) and supplemented by the glossary of curriculum terminology (IBE, 2013) and the UIS Glossary¹. **Table 2** contains the resulting definitions.

¹ Available from: <http://uis.unesco.org/en/glossary>

Table 1. Global Content Framework for SDG indicators 4.7.1, 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 of 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)
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	
Education for Sustainable Development (ESD)	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)		
Environmental Science (geoscience)	Waste management, recycling	
	Physical systems	
	Living systems	
		Earth and space systems

Table 2. Definition and operationalization of national education policies, curricula, teacher education and student assessments

Definition	Operationalization
Education policies	
Formal decisions made by government or education authorities that have a direct or significant effect on the curriculum, its development and implementation. These decisions are normally recorded in a range of official documents.	The mainstreaming of GCED and ESD in legal frameworks (e.g., the constitution, domestic legislation, specific laws or regulations, etc.) at national and sub-national levels at each level of education (e.g. pre-primary, primary, secondary, tertiary, non-formal education).
Curriculum	
Design, planning and sequencing of teaching and learning processes. It includes a statement of purpose, contents, activities and learning practices, as well as the modalities for assessing learners' achievements.	The mainstreaming of GCED and ESD in curricula at each level of education including: coverage of the topics in mandatory subjects and extracurricular activities.
Teacher education	
Formal teacher training (pre-service or in-service) designed to equip teachers with the knowledge, attitude, behavior and skills required for teaching at the relevant level.	The mainstreaming of GCED and ESD in initial and continuing professional development of teachers at each level of education.
Student Assessment	
The process through which the progress and achievements of a learner or learners is measured or judged in compliance with specific quality criteria.	The mainstreaming of GCED and ESD in student assessments and examinations addressing student knowledge and skills, values, attitudes and behaviors, at each level of education.

Regarding the concept of “curriculum” we make two observations:

- Curriculum definitions vary (see IBE, 2013). In a broad sense, the term curriculum may include all the other aspects mentioned above (i.e. policy, teacher education, student assessment). In the current (more limited) operationalization, curriculum refers mainly to learning objectives/competencies, content/topics covered, and planned learning experiences.
- A potentially relevant distinction that could become informative for the current framework and exercise is that between intended curriculum, implemented curriculum and attained curriculum.

Intended curriculum. A set of formal documents which specify what the relevant national education authorities and society expect that students will learn at school in terms of knowledge, understanding, skills, values, and attitudes to be acquired and developed, and how the outcomes of the teaching and learning process will be assessed. It is usually embodied in the curriculum framework(s) and guides, syllabi, textbooks, teacher’s guides, the content of tests and examinations, regulations, policies and other official documents.

Implemented curriculum. The actual teaching and learning activities taking place in schools through interaction between learners and teachers as well as among learners, e.g. how the intended curriculum is translated into practice and actually delivered.

Attained curriculum. The curriculum which indicates the knowledge, understanding, skills and attitudes that learners actually acquire as a result of teaching and learning, assessed through different means and/or demonstrated in practice.

In the current UNESCO frameworks and measurement, indicator SDG 4.7.1 is particularly focused on *intended* curriculum while other indicators (e.g. 4.7.4; 4.7.5) are captured by the *attained* curriculum. Furthermore, indicator SDG 4.7.1 could eventually also consider to cover aspects of the implemented curriculum (we come back to this point later in the document).

B. Mapping existing tools from ILSAs into SDG thematic indicators 4.7.1, 4.7.4 and 4.7.5

B.1 Mapping exercise for SDG global indicator 4.7.1

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 assessments

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

First, informed by the operationalizations identified above, we consulted the latest version of the frameworks and the instruments/questionnaires applied in several ILSAs of student and teacher outcomes. We particularly focused on studies and instruments that could potentially provide information about the intended curriculum (e.g. by means of national context questionnaires or country encyclopaedias). These were the OECD Teaching and Learning International Survey (TALIS)², the IEA Trends in International Mathematics and Science Study (TIMSS)³, the OECD Programme for International Student Assessment (PISA)⁴ and the IEA International Civic and Citizenship Study (ICCS)⁵. We assessed these sources of information with the following criteria in mind: the assessment framework should (at least partially) refer to the concepts relevant to SDG 4.7.1, the instruments should provide sufficient information on many of the aspects/concepts involved, and they should potentially allow long-term monitoring.

As a result of this exercise, we identified the ICCS 2016 study as the most comprehensive source of information for the global indicator SDG 4.7.1. We must, however, mention that other surveys could also be informative. For example, TALIS could provide some information about some of the aspects of GCED and ESD in teacher education.

Specifically, the ICCS 2016 study was singled out for the following reasons:

- The 2016 ICCS assessment framework explicitly considered both GCED and ESD. Most themes/aspects of GCED and ESD are considered to overlap and are conceptualized under the umbrella term “civic and

² See: <http://www.oecd.org/education/talis/>

³ See: <https://www.iea.nl/timss>

⁴ See: <http://www.oecd.org/pisa/>

⁵ See: <https://iccs.iea.nl/home.html>

citizenship education” (CCE) (Schulz, Ainley, Fraillon, Losito, & Agrusti, 2016, pp 4-5; Schulz, Ainley, et al., 2018) and an effort was made to cover these topics with all the instruments;

- Various sources of information are captured by several instruments (e.g. National context survey, School questionnaire, Teacher questionnaire, Student Questionnaire);
- The focus on GCED and ESD are part of the main survey (i.e. they are not optional). They are a core part of the ICCS assessment framework, they are highly likely to be retained in subsequent waves of the study, allowing for monitoring over time;
- Some of the indicators relevant for SDG 4.7.1 are already used by IEA and other international organizations (e.g. EC/Eurydice) to inform civic and citizenship education policies.

Second, we reviewed the ICCS 2016 instruments, the items and the data that could be relevant for SDG 4.7.1 (see Köhler, Weber, Brese, Schulz, & Carstens, 2018; Schulz, Carstens, Losito, & Fraillon, 2018). Given the current focus of indicator SDG 4.7.1 on *intended* curriculum we identified the items included in the National Context Survey (NCS) completed by the ICCS National Research Coordinators (NRCs)⁶ to be the most informative. The ICCS 2016 NRCs had the task to review official curricular documents prior to answering the questionnaire. Please see Appendix 1 for further information regarding the development and implementation of the ICCS 2016 NCS.

Appendix 2 lists the questions and items that were retained for our mapping exercise and Table 3 provides an overview of the results of data analysis⁷ assuming an intended curriculum perspective. The first column lists the countries that participated in ICCS 2016. The other columns correspond to the GCED and ESD categories defined in our content framework (see Table 2), and the black dots indicate that the category is present in the corresponding documentation.

A few observations can be made based on the information included in **Table 3**:

- The National Context Survey is a relevant instrument to measure the aspects of SDG 4.7.1 on GCED and ESD. It provides information to evaluate whether GCED and ESD are present in national education policies, curricula, teacher education, and student assessments.
- For the curricula, it provides information for six out of the seven categories included in our content framework (at least one sub-category for each category). Only the category of Health and Well-being is not covered.
- For the other aspects, the coverage is more limited but allows to identify whether GCED and ESD, as general concepts, are present in national education policies, teacher education, and student assessments.
- The information is mainly relevant for secondary education and in particular for the **ICCS target grade, 8**. This aspect is important to be stressed in potential future reporting as some countries may mainstream GCED and ESD at different levels of education (e.g. primary education) or may have cross-curricular goals that are not linked to a specific target grade.

Appendix 2 includes the specific items from the NCS and the categories from our content framework that they cover. We note that in ICCS 2016 GCED and ESD are assumed to be overlapping and are conceptualized under the umbrella term “civic and citizenship education (CCE)”. This means that for areas such as policy, teacher

⁶ The full instrument and the procedure followed to complete it are available in Köhler, et al. (2018).

⁷ ICCS 2016 NCS data was retrieved from <https://www.iea.nl/data-tools/repository> on 05-07-2019

In addition, our analysis of ICCS 2016 information, also provides insights for further potential sources of information for SDG 4.7.1. For example, if an *implemented* curriculum perspective is applied, the information collected by the ICCS 2016 School questionnaire and/or the Teacher questionnaire and the Student Questionnaire would be very useful. Appendix 3 provides some examples of potentially informative items (much more information can be identified if needed). These questionnaires have the potential to increase the coverage of GCED and ESD categories, particularly in the curriculum, teacher education and student assessments.

B.2 Mapping exercise for SDG global indicator 4.7.4

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

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

First, informed by the content framework developed in section A, we consulted the latest version of the frameworks and the instruments/questionnaires applied by two ILSAs of student outcomes. According to the definition of indicator 4.7.4, we consider only the first five categories included in our content framework. We particularly focused on studies and instruments that could potentially provide information about attained curriculum (e.g. by means of student assessment and background questionnaires). These were the OECD Programme for International Student Assessment (PISA)⁸ and the IEA International Civic and Citizenship Study (ICCS)⁹. We assessed these sources of information with the following criteria in mind: the assessment framework should refer to the concepts relevant to SDG 4.7.4, the instruments 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 ICCS 2016 study as the most comprehensive source of information for the global indicator SDG 4.7.4 as it contains information for five out of the six categories considered for this indicator (Interconnectedness and Global Citizenship, Gender Equality, Peace, Human Rights, Sustainable Development). PISA 2018 contains information for the remaining category (Health and Well-being).

Second, we reviewed the instruments and items that could be relevant for SDG 4.7.4 (see OECD, 2019; Schulz et al., 2016). Drawing on a review of recent work in the area of global citizenship education, we decided to incorporate the three core dimensions proposed UNESCO to measure learning outcomes in GCED in this mapping exercise (UNESCO, 2015). These dimensions are interrelated and are presented below, each indicating the domain of learning they focus on most in the learning process.

Tables 5 to 10 provide an overview of our mapping exercise assuming an attained curriculum perspective. The first column lists the GCED and ESD categories and sub-categories defined in our content framework. The other columns correspond to the ILSAs' contents identified that map into the GCED and ESD categories and sub-categories, according to each of the three dimensions of the UNESCO's model of global competence.

⁸ See: <http://www.oecd.org/pisa/>

⁹ See: <https://iccs.iea.nl/home.html>

Table 4. 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.
Socio-emotional:
To have a sense of belonging to a common humanity, sharing values and responsibilities, empathy, solidarity 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.

This overview is in line with the current focus of indicator SDG 4.7.4 on *attained* curriculum and it is based on the items included in the assessment frameworks of ICCS 2016 (Schulz et al., 2016) and PISA 2018 (OECD, 2019).

A few observations can be made based on the information included in Tables 5 to 10:

- ICCS 2016 is the most comprehensive source of information for the global indicator SDG 4.7.4 as it contains information for five out of the six categories considered for this indicator (Interconnectedness and Global Citizenship, Gender Equality, Peace, Human Rights, Sustainable Development). It also contains information for all the sub-categories within these five categories, either for the Cognitive, Socio-emotional or Behavioural dimensions.
- PISA 2018 contains information for the remaining category (Health and Well-being), including all its sub-categories, as well as for some other sub-categories from the other categories (e.g. Sustainable Development and Interconnectedness and Global Citizenship).
- Most of the contents identified correspond to scales or composite indicators but some contents are only available as single items. Previous studies that measure well-being have often relied on single-item indicators or on a set of very few questions (see, for example, Casas et al., 2012). While this approach is easy to administer, it is conceptually unsatisfactory and potentially invalid and unreliable (we will come back to this point in the conclusions).
- While carrying out this mapping exercise, it became clear that some of the sub-categories could be collapsed since they clearly refer to the same concepts and because of the level of detail included in the assessment frameworks, it is not possible to produce an exact match. For example, the sub-categories: 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); and Waste management, recycling, could be collapsed with the sub-category Environmental sustainability/environmentally sustainable.
- All the information is mainly relevant for secondary education and in particular for the ICCS target grade, 8.

- *Table 5. Data availability for GCED and ESD (Interconnectedness and Global Citizenship) in ICCS 2016 and PISA 2018*

Category / Sub-category	Dimension		
	Cognitive	Socio-emotional	Behavioural
Interconnectedness and Global Citizenship			
Globalization	ICCS assessment test; Content domain 1: Civic society and systems; Sub-domain: Citizens; Key concept: Globalization		
Global/international citizen(ship), global culture/identity/community	ICCS assessment test; Content domain 4: Civic identities; Sub-domain: Civic connectedness; Key concept: Global citizenship	ICCS student background questionnaire; Affective-behavioral domain 1: Attitudes; Content domain: Students' attitudes toward civic society and systems and Students' attitudes toward civic identities; Construct: Students' attitudes toward the European Union (European regional questionnaire) and Students' sense of European identity (European regional questionnaire)	
Global-local thinking, local-global, think global act local, glocal	ICCS assessment test; Content domain 4: Civic identities; Sub-domain: Civic connectedness; Key concept: Cultures / location	ICCS student background questionnaire; Affective-behavioral domain 1: Attitudes; Content domain: Students' attitudes toward civic identities; Construct: Students' attitudes toward their country of residence	
Multicultural(ism)/intercultural (ism)	ICCS assessment test; Content domain 4: Civic identities; Sub-domain: Civic connectedness; Key concept: Diversity PISA assessment test; Content Domain 1: Culture and intercultural relations; Sub-domain: Identity formation in multicultural societies, Cultural expressions and cultural exchanges, Intercultural communication, Perspective taking, stereotypes, discrimination and intolerance	ICCS student background questionnaire; Affective-behavioral domain 1: Attitudes; Content domain: Students' attitudes toward civic principles; Construct: Students' attitudes toward equal rights for all ethnic/racial groups and Students' perception of discrimination of minorities in Latin American societies (Latin American regional questionnaire)	
Migration, immigration, mobility, movement of people		ICCS student background questionnaire; Affective-behavioral domain 1: Attitudes; Content domain: Students' attitudes toward civic principles; Construct: Students' attitudes toward equal rights for immigrants (European regional questionnaires)	
Global Competition/competitiveness/globally competitive/international competitiveness	PISA assessment test (Global competence); Content Domain 2: Socio-economic development and interdependence; Sub-domain: Economic interactions and interdependence		
Global Inequalities/disparities	ICCS assessment test; Content domain 2: Civic principles; Sub-domain: Equity; Key concept: Social Justice PISA assessment test (Global competence); Content Domain 2: Socio-economic development and interdependence; Sub-domain: Human capital, development and inequality		

Table 6. Data availability for GCED and ESD (Gender Equality) in ICCS 2016 and PISA 2018

Category / Sub-category	Dimension		
	Cognitive	Socio-emotional	Behavioural
Gender Equality			
Gender equality / equality / parity	ICCS assessment test; Content domain 2: Civic principles; Sub-domain: Equity; Key concept: Equality	ICCS student background questionnaire; Affective-behavioral domain 1: Attitudes; Content domain: Students' attitudes toward civic principles; Construct: Students' attitudes toward gender rights	
Empower(ment of) women/girls (female empowerment, encouraging female participation)			

Table 7. Data availability for GCED and ESD (Peace, Non-violence and Human security) in ICCS 2016 and PISA 2018

Category / Sub-category	Dimension		
	Cognitive	Socio-emotional	Behavioural
Peace, Non-violence and Human Security			
Peace, peace-building	ICCS assessment test; Content domain 3: Civic participation; Sub-domain: influencing; Key concept: Negotiation/resolution	ICCS student background questionnaire; Affective-behavioral domain 1: Attitudes; Content domain: Students' attitudes toward civic participation; Construct: Students' attitudes toward violence (Latin American regional questionnaire)	
Awareness of forms of abuse/harassment/violence (school-based violence/bullying, household-based violence, gender-based violence, child abuse/harassment, sexual abuse/harassment)			ICCS student background questionnaire; Contextual framework level: The contexts of schools and classrooms; Construct: Students' reports on personal experiences of bullying and abuse

Table 8. Data availability for GCED and ESD (Human Rights) in ICCS 2016 and PISA 2018

Category / Sub-category	Dimension		
	Cognitive	Socio-emotional	Behavioural
Human Rights			
Human rights, rights and responsibilities (children's rights, cultural rights, indigenous rights, women's rights, disability rights)	ICCS assessment test; Content domain 2: Civic principles; Sub-domain: Rule of law; Key concept: Human rights	ICCS student background questionnaire; Affective-behavioral domain 1: Attitudes; Content domain: Students' attitudes toward civic principles; Construct: Students' attitudes toward gender rights, Students' attitudes toward equal rights for all ethnic/racial groups, Students' attitudes toward equal rights for immigrants (European regional questionnaires)	
Freedom (of expression, of speech, of press, of association/organisation), civil liberties	ICCS assessment test; Content domain 2: Civic principles; Sub-domain: Freedom; Key concept: Human rights	ICCS student background questionnaire; Affective-behavioral domain 1: Attitudes; Content domain: Students' attitudes toward civic principles; Item: Which of the following situations do you think would be good, neither good nor bad, or bad for democracy? - People are allowed to publicly criticize the government One company or the government owns all newspapers in a country, People are able to protest if they think a law is unfair	
Social justice	ICCS assessment test; Content domain 2: Civic principles; Sub-domain: Equity; Key concept: Social justice	ICCS student background questionnaire; Affective-behavioral domain 1: Attitudes; Content domain: Students' attitudes toward civic society and systems; Construct: Students' perception of the importance of social movement related citizenship	ICCS student background questionnaire; Affective-behavioral domain 1: Engagement; Content domain: Behavioural intentions; Construct: Expectations to participate in legal and illegal forms of civic action in support of or protest against important issues
Democracy/democratic rule, democratic values/principles	ICCS assessment test; Content domain 1: Civic society and systems; Sub-domains: State institutions and Civil institutions; Key concept: Democracy	ICCS student background questionnaire; Affective-behavioral domain 1: Attitudes; Content domain: Students' attitudes towards democratic values	

Table 9. Data availability for GCED and ESD (Health and Well-being) in ICCS 2016 and PISA 2018

Category / Sub-category	Dimension		
	Cognitive	Socio-emotional	Behavioural
Health and Well-being			
Physical health/activity/fitness			PISA student background questionnaire; Well-being domain; Sub-domain: Self-rated wellbeing; Construct: Health (students' physical exercise habits)
Mental, emotional health, psychological health			PISA student background questionnaire; Well-being domain; Sub-domain: Self-rated wellbeing; Construct: Psychological functioning
Healthy lifestyle (nutrition, diet, cleanliness, hygiene, sanitation, *clean water, being/staying healthy)			PISA student background questionnaire; Well-being domain; Sub-domain: Self-rated wellbeing; Construct: Health (student's typical duration of sleep)
Awareness of addictions (smoking, drugs, alcohol)			PISA student background questionnaire; Well-being domain; Sub-domain: Self-rated wellbeing; Construct: Health (student's behaviours associated with health risks)
Sexual and/or reproductive health			PISA student background questionnaire; Well-being domain; Sub-domain: Self-rated wellbeing; Construct: Health (student's sexual risky behaviour)

Table 10. Data availability for GCED and ESD (Sustainable Development) in ICCS 2016 and PISA 2018

Category / Sub-category	Dimension		
	Cognitive	Socio-emotional	Behavioural
Sustainable Development			
Economic sustainability, sustainable growth, sustainable production/consumption, green economy	ICCS assessment test; Content domain 1: Civic society and systems; Sub-domain: Civil institutions and State institutions; Key concept: Sustainable development and The economy	ICCS student background questionnaire; Affective-behavioral domain 1: Attitudes; Content domain: Students' attitudes toward civic society and systems; Item: To what extent do you think the following issues are a threat to the world's future? – Global financial crises, Food shortages	
Social sustainability, (social cohesion re sustainability)	ICCS assessment test; Content domain 2: Civic principles; Sub-domain: Sense of community; Key concept: Concern for the common good	ICCS student background questionnaire; Affective-behavioral domain 1: Attitudes; Content domain: Students' attitudes toward civic society and systems; Item: To what extent do you think the following issues are a threat To the world's future? – Poverty, Unemployment, Crime, Violent conflict	
Environmental sustainability/environmentally sustainable	ICCS assessment test; Content domain 1: Civic society and systems; Sub-domain: Civil institutions; Key concept: Environmental sustainability PISA assessment test (Global competence); Content Domain 3: Environmental sustainability; Sub-domain: Natural resources and environmental risks, Policies, practices and behaviours for environmental sustainability	ICCS student background questionnaire; Affective-behavioral domain 1: Attitudes; Content domain: Students' attitudes toward civic society and systems; Item: To what extent do you think the following issues are a threat To the world's future? – Pollution	
Climate change (global warming, carbon emissions/footprint)	*ICCS assessment test; Content domain 1: Civic society and systems; Sub-domain: Civil institutions; Key concept: Environmental sustainability PISA assessment test (Global competence); Content Domain 3: Environmental sustainability; Sub-domain: Natural resources and environmental risks, Policies, practices and behaviours for environmental sustainability	IS3G28I (To what extent do you think the following issues are a threat to the world's future? – Climate change, Likert scale)	
Renewable energy, alternative energy (sources) (solar, tidal, wind, wave, geothermal, biomass...)	*ICCS assessment test; Content domain 1: Civic society and systems; Sub-domain: Civil institutions; Key concept: Environmental sustainability PISA assessment test (Global competence); Content Domain 3: Environmental sustainability; Sub-domain: Natural resources and environmental risks, Policies, practices and behaviours for environmental sustainability	ICCS student background questionnaire; Affective-behavioral domain 1: Attitudes; Content domain: Students' attitudes toward civic society and systems; Item: To what extent do you think the following issues are a threat to the world's future? – Energy shortages	
Ecology, ecological sustainability (ecosystems, biodiversity, biosphere, ecology, loss of diversity)	*ICCS assessment test; Content domain 1: Civic society and systems; Sub-domain: Civil institutions; Key concept: Environmental sustainability PISA assessment test (Global competence); Content Domain 3: Environmental sustainability; Sub-domain: Natural resources and environmental risks, Policies, practices and behaviours for environmental sustainability		ICCS student background questionnaire; Affective-behavioral domain 1: Engagement; Content domain: Civic participation; Item: At school, have you ever done any of the following activities? - Participating in an activity to make the school more <environmentally friendly> (e.g. through water saving or recycling)
Waste management, recycling	*ICCS assessment test; Content domain 1: Civic society and systems; Sub-domain: Civil institutions; Key concept: Environmental sustainability PISA assessment test (Global competence); Content Domain 3: Environmental sustainability; Sub-domain: Natural resources and environmental risks, Policies, practices and behaviours for environmental sustainability	ICCS student background questionnaire; Affective-behavioral domain 1: Attitudes; Content domain: Students' attitudes toward civic society and systems; Item: To what extent do you think the following issues are a threat to the world's future? – Water shortages and Importance of behaviours as an adult - Making personal efforts to protect natural resources (e.g. through saving water or recycling waste)	

* These sub-categories are not explicitly mentioned in the ICCS 2016 or the PISA 2018 frameworks but can be considered to be contained by the sub-category Environmental sustainability.

B.3 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 analytic strategy:

First, informed by the content framework developed in section A, 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)¹⁰ and the IEA Trends in International Mathematics and Science Study (TIMSS)¹¹. 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 instruments 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; Mullis & Martin, 2017) to identify the contents of this study that can be used to measure the corresponding categories and sub-categories from our 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 indicator 4.7.4, we decided to incorporate the same three core dimensions to measure learning outcomes than those proposed for GCE. The core dimensions are the same 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 below¹², each indicating the domain of learning they focus on most in the learning process:

Table 11. Core conceptual dimensions of environmental education

¹⁰ See: <http://www.oecd.org/pisa/>

¹¹ See: <https://www.iea.nl/timss/>

¹² The descriptions of the core conceptual dimensions are based on the TIMSS 2019 assessment framework. Their full theoretical background and rationale can be consulted in Mullins and Martin (2017).

Cognitive:

To acquire knowledge, understanding and critical thinking necessary to encompassing the range of cognitive processes involved in learning environmental science concepts, and then applying these concepts and reasoning with them.

Socio-emotional:

To have intrinsic motivation to learn environmental science.

Behavioural:

To have self-confidence or self-concept in their ability to learn environmental science.

Table 12 provides an overview of our mapping exercise assuming an *attained* curriculum perspective. The first column lists the environmental science categories and sub-categories defined in our content framework. The other columns correspond to the ILSAs' contents identified that map into the environmental science categories and sub-categories.

A few observations can be made based on the information included in Table 12:

- All the categories and sub-categories of the content framework, as well as the learning dimensions of the environmental education model, can be covered with the contents of TIMSS.
- All the contents identified correspond to scales or composite indicators.
- All the information is mainly relevant for secondary education and in particular for the TIMSS target grade, 8.

Table 12. Data availability for Environmental Science in ICCS 2016 and PISA 2018

Category / Sub-category	Dimension		
	Cognitive	Socio-emotional	Behavioural
Environmental Science (geoscience)			
Physical systems	TIMSS assessment test; Content domain: Physical science; Sub-domain: Physical States and Changes in Matter; Key concept: Changes in states of matter	TIMSS background questionnaire; Contextual framework level: Student attitudes toward learning; Construct: Students Like Learning Physics	TIMSS background questionnaire; Contextual framework level: Student attitudes toward learning; Construct: Students Confident in Physics
Living systems	TIMSS assessment test (eight grade); Content domain: Biology; Sub-domain: Life Cycles, Reproduction, and Heredity; Key concept: Life cycles and patterns of development, Sexual reproduction and inheritance in plants and animals TIMSS assessment test; Content domain: Biology; Sub-domain: Ecosystems; Key concept: The flow of energy in ecosystems, The cycling of water, oxygen, and carbon in ecosystems, Interdependence of populations of organisms in an ecosystem, Human impact on the environment	TIMSS background questionnaire; Contextual framework level: Student attitudes toward learning; Construct: Students Like Learning Biology	TIMSS background questionnaire; Contextual framework level: Student attitudes toward learning; Construct: Students Confident in Biology
Earth and space systems	TIMSS assessment test; Content domain: Earth Science; Sub-domain: Earth's Structure and Physical Features; Key concept: Earth's structure and physical characteristics, Components of Earth's atmosphere and atmospheric conditions TIMSS assessment test; Content domain: Earth Science; Sub-domain: Earth's Processes, Cycles, and History; Key concept: Geological processes, Earth's water cycle, Weather and climate TIMSS assessment test; Content domain: Earth Science; Sub-domain: Earth's Resources, Their Use and Conservation; Key concept: Managing Earth's resources, Land and water use TIMSS assessment test; Content domain: Earth Science; Sub-domain: Earth in the Solar System and the Universe; Key concept: Observable phenomena on Earth resulting from movements of Earth and the Moon, The Sun, stars, Earth, Moon, and planets	TIMSS background questionnaire; Contextual framework level: Student attitudes toward learning; Construct: Students Like Learning Earth Science	TIMSS background questionnaire; Contextual framework level: Student attitudes toward learning; Construct: Students Confident in Earth Science

C. Definition of proficiency levels for SDG thematic indicators 4.7.1, 4.7.4 and 4.7.5

C.1 Definition of scores for SDG global indicator 4.7.1

The core of Indicator 4.7.1 is measuring the extent to which GCED and ESD are mainstreamed in (a) national education educational policies, (b) curricula, (c) teacher education, (d) student assessment. As such, this global indicator does not require the definition of a minimal level of mainstreaming. In this case, the optimal level would be the systematic inclusion of GCED and ESD in all the areas described in the indicator. So, what we propose here is to measure the prevalence of GCED and ESD in national education educational policies, curricula, teacher education, and student assessment, based on a series of dichotomous items.

The computation of the score is rather simple and is based on the intersection between the data collected through the ICCS National Contexts Survey (NSC) and the content framework presented in section A (see Table 3). A summary of the categories and sub-categories under GCED and ESD covered by the NCS for each area is illustrated in **Table 13**.

Table 13. ICCS coverage of GCED and ESD categories

		National education policy	Curricula	Teacher education	Student assessment
GCED	GCED and ESD as a general concept	X	X	X	X
	Interconnectedness and Global Citizenship		X		
	Gender Equality		X		
	Peace, Non-violence and Human Security		X		
	Human Rights		X		
ESD	Health and Well-being				
	Sustainable Development		X		

Because of limitations of the data available, for national education policy, teacher education and student assessment the presence of GCED and ESD can only be measured at the general level where GCED and ESD are captured under the umbrella term “civic and citizenship education (CCE)”.

Given the ICCS 2016 NCS data availability (please refer to Table 3) we could envision computing two types of scores:

- a) Scores representing each area of SDG 4.7.1.

SDG 4.7.1. refers to several topics under GCED and ESD and their mainstreaming in four areas: (a) national education policies (b) curricula (c) teacher education and (d) student assessments.

We selected indicators/questions related to a specific component of each of the four areas: national education policies = 1 indicator; (b) curricula = 5 indicators; (c) teacher education = 6 indicators and (d) student assessments = 1 indicator.

For each indicators/question, there are 2 options: 1 = “Yes” and 0 = “No” (in Table 3, the black dots represent a response category of 1 while an empty cell indicates a response category of 0). Therefore, the maximum of 1 point is awarded when GCED and ESD are mainstreamed in different indicators under the four areas.

We could compute scores for each area in the following fashion: Within each of the four areas (i.e. (a) national education policies (b) curricula (c) teacher education and (d) student assessments), the indicator scores are summed together to give a score for that area. These scores are converted into a 0 to 100 scale for each dimension where 100% is the top score. E.g.:

National education policies = Yes (1) = 100%.

Student assessments = Yes (1) = 100%.

Curricula = $(\text{SUM}(\text{Indicator1}, \dots, \text{Indicator5})/5) * 100$.

Teacher education = $(\text{SUM}(\text{Indicator1}, \dots, \text{Indicator6})/6)$

b) Overall scores for SDG 4.7.1.

The overall score could be computed as a weighted sum of the scores representing the four areas. Alternative weighting methods could be discussed depending on the substantive importance assigned to each of the indicators and the four areas. We consider that this decision should lie with the stakeholders involved in the process of developing an SDG measurement strategy proposal. We give here two examples:

Example 1: Overall score with equal weights for all indicators

In this computation all thirteen indicators under the four areas count the same. This also means that overall, the areas of curriculum and teacher education are weighted more because they contain more indicators.

Overall Score SDG 4.7.1. V1 = $(\text{SUM}(\text{National education policies} *1, \text{Curricula} *5, \text{Teacher education} *6, \text{Student assessments} *1)/13)$.

Example 2: Overall score with equal weights for all areas

In this computation, the four areas contribute equally to the overall score.

Overall Score SDG 4.7.1. V2 = $(\text{SUM}(\text{National education policies}, \text{Curricula}, \text{Teacher education}, \text{Student assessments})/4)$.

Examples of all scores for the countries participating in ICCS 2016 are presented in **Table 14**.

Table 14. Scores for indicator 4.7.1 (by area and overall).

	National education policies	Curricula	Teacher education	Student assessment	Overall Score V1	Overall Score V2
BFL	0	100	67	0	69	42
BGR	100	80	50	100	69	83
CHL	100	80	33	100	62	78
COL	0	60	50	100	54	53
DNK	100	20	33	100	38	63
DNW	100	100	67	100	85	92
DOM	100	100	17	100	62	79
EST	100	40	100	100	77	85
FIN	100	N/A	33	0	23	33
HKG	100	80	50	100	69	83
HRV	100	80	33	100	62	78
ITA	100	100	67	100	85	92
KOR	0	60	17	100	38	44
LTU	100	100	67	0	77	67
LVA	100	0	100	0	54	50
MEX	100	100	100	100	100	100
MLT	100	80	50	100	69	83
NLD	100	100	17	0	54	54
NOR	100	100	50	0	69	63
PER	100	80	67	100	77	87
RUS	100	80	67	100	77	87
SVN	100	80	17	100	54	74
SWE	100	100	67	0	77	67
TWN	100	100	67	100	85	92

In addition, if an implemented curriculum approach could be of interest, then we will need to consider the structure of the ICCS 2016 data for responses of school principals, teachers and students. For example, if we were to construct an indicator related to the mainstreaming of ESD in the Implemented Curriculum in terms of Aims, we could make use of the information provided by Appendix 3, Q16, item b) (e.g. What do you consider the most important aims of civic and citizenship education at school?; Indicate the three aims that in your opinion ought to be the most important by ticking the three appropriate boxes.; b) Promoting respect for and safeguard of the environment). This question was addressed to the school principals in schools where students of ICCS 2016 target grade 8 were located. A potential score for this indicator would then represent “the proportion of students at schools (in each country) where principals reported the aim related to ESD as one of the 3 most important aims”¹³.

¹³ For a data-based example, please see the ICCS 2016 International report (Schulz, et al. 2018), pp. 33

C.2 Definition of proficiency levels for SDG thematic indicator 4.7.4

The thematic indicator 4.7.4 measures the percentage of students showing adequate understanding of issues relating to global citizenship and sustainability. The challenge of defining a proficiency level is to determine what constitutes a minimal or in this case an adequate, level of competency among different education realities around the world. As Treviño and Órdenes (2017) point out, every country or region in the world has different needs and rhythm in terms of education development for their citizens. Some countries might be struggling to increase coverage in elementary education, while others might be focusing on keeping high standards of quality learning for all their citizens. So, in terms of public policy, this means that each country will have different expectations of what is the minimal level of knowledge and skills in literacy and numeracy for their citizens.

There are also practical challenges. For example, the relevant content of ESD and GCED focuses on both covering knowledge and other sets learning outcomes such as skills, values and attitudes. In the case of the later (e.g. values, attitudes), measuring “adequate understanding” is not necessarily the most relevant measurement criterion. Even for the cognitive component, the extent of variation in the definition of “showing adequate understanding” in different contexts represents a significant challenge for the establishment of benchmark levels and cut scores that can be communicated well globally.

There is, however, work that has been advanced in this direction by the institutions organising ILSAs. Specifically, for the definition of proficiency levels to measure and monitor the cognitive dimension of thematic indicator 4.7.4, the IEA has developed a civic knowledge proficiency scale with four levels, that includes descriptions of the scale’s contents and the nature of the progression across the proficiency levels (see **Figure 1**).

We consider that, given that most of the categories of the content framework are covered by the contents of ICCS 2016, the most practical way of establishing a threshold for “an adequate understanding of issues relating to global citizenship and sustainability” is by utilising the methodology developed by IEA in this study. An analysis of the civic knowledge proficiency scale and the descriptions of its contents and examples suggests that it would be possible to adapt the existing scale for the purposes of indicator 4.7.4. There is, however, an important amount of work needed to accomplish this task. For example, the constructs or key concepts identified in the mapping exercise would need to be scaled using the same methodology used in ICCS to compute indices for each of the categories in the content framework. Then, the same procedure followed to establish the ICCS civic knowledge scale would need to be followed for each of the categories (see Schulz, Ainley, et al., 2018, pp 44-47). The specific level to be considered as “adequate” is to be decided by the stakeholders involved in the process of developing an SDG measurement strategy proposal, but having a knowledge proficiency scale would offer a concrete framework to do so. For example, if for the category Interconnectedness and Global Citizenship, “adequate” level was to be considered “demonstrating familiarity with concepts like global culture, global-local thinking, multiculturalism, etc. as principles of global citizenship”, an adequate understanding of issues relating to global citizenship could be established at the level C of the knowledge scale.

Figure 1. ICCS civic knowledge scale with examples

Level A: 563 score points and above

Students working at Level A make connections between the processes of social and political organization and influence, and the legal and institutional mechanisms used to control them. They generate accurate hypotheses on the benefits, motivations, and likely outcomes of institutional policies and citizens' actions. They integrate, justify, and evaluate given positions, policies, or laws based on the principles that underpin them. Students demonstrate familiarity with broad international economic forces and the strategic nature of active participation.

Students working at Level A, for example:

- Identify likely strategic aims of a program of ethical consumption
- Suggest mechanisms by which open public debate and communication can benefit society
- Suggest related benefits of widespread intercultural understanding in society
- Justify the separation of powers between the judiciary and the parliament
- Relate the principle of fair and equal governance to laws regarding disclosure of financial donations to political parties
- Evaluate a policy with respect to equality and inclusiveness
- Identify a reason for having limited parliamentary terms
- Identify the main feature of free market economies and multinational company ownership.

Level B: 479 to 562 score points

Students working at Level B demonstrate familiarity with the broad concept of representative democracy as a political system. They recognize ways in which institutions and laws can be used to protect and promote a society's values and principles. They recognize the potential role of citizens as voters in a representative democracy, and they generalize principles and values from specific examples of policies and laws (including human rights). Students demonstrate understanding of the influence that active citizenship can have beyond the local community. They generalize the role of the individual active citizen to broader civic societies and the world.

Students working at Level B, for example:

- Relate the independence of a statutory authority to maintenance of public trust in decisions made by the authority
- Generalize the economic risk to developing countries of globalization from a local context
- Identify that informed citizens are better able to make decisions when voting in elections
- Relate the responsibility to vote with the representativeness of a democracy
- Describe the main role of a legislature/parliament
- Define the main role of a constitution
- Recognize the relationship between the government and the military in a democracy
- Recognize the danger of government-controlled media
- Relate the responsibility for environmental protection to the actions of individual people.

Level C: 395 to 478 score points

Students working at Level C demonstrate familiarity with equality, social cohesion, and freedom as principles of democracy. They relate these broad principles to everyday examples of situations in which protection of or challenge to the principles are demonstrated. Students also demonstrate familiarity with fundamental concepts of the individual as an active citizen: they recognize the necessity for individuals to obey the law; they relate individual courses of action to likely outcomes; and they relate personal characteristics to the capacity of an individual to effect civic change.

Students working at Level C, for example:

- Relate freedom of the press to the accuracy of information provided to the public by the media
- Justify voluntary voting in the context of freedom of political expression
- Identify that democratic leaders should be aware of the needs of the people over whom they have authority
- Recognize that the UN Universal Declaration of Human Rights is intended to apply to all people
- Generalize about the value of the internet as a communicative tool in civic participation
- Recognize the value of being an informed voter
- Recognize that governments have a responsibility to all citizens
- Recognize the civic motivation behind an act of ethical consumerism.

Level D: 311 to 394 score points

Students working at Level D recognize explicit examples representing basic features of democracy. They identify the intended outcomes of simple examples of rules and laws and recognize the motivations of people engaged in activities that contribute to the common good.

Students working at Level D, for example:

- Recognize national defense is a key role of the military
- Relate the right to medical help to the motivation to work for an aid organization
- Recognize the relationship between the secret ballot and freedom of voter choice
- Recognize that volunteers provide a contribution to communities
- Recognize that all people are equal before the law.

To provide an approach to reporting the socio-emotional and behavioural dimensions of the indicator 4.7.4 analogous to the cognitive proficiency scale, a similar method would need to be followed. First, an index would need to be constructed for each of the sub-categories of the content framework¹⁴. Then, each of these indices would need to be divided into high, middle, and low regions and a content-referenced interpretation for these regions would need to be provided. The particular response combinations that define the regions boundaries, or cut points, are based on a judgment of what constitutes a high or low region on each individual scale. For example, based on a consideration of the questions making up an index called Students' Sense of Belonging, it could be determined that in order to be in the high region of the index (e.g. be labelled as having a "High Sense of Belonging"), a student would have to agree a lot, on average, to at least four of the seven statements and agree a little to the other three (assuming the index is composed of seven items). Similarly, it could be determined that a student who, on average, at most agreed a little with three of the statements and disagreed a little with the other four would be labelled as having "Little Sense of Belonging". Then, the indicator could be reported as the percentage of students showing a "high" sense of belonging (instead of an adequate level of belonging). A detailed example of this method can be found in Martin et al. (2016).

The final step would be to compute a score for each of the categories identified in the content framework. This could be the average or the proportion of the students reaching the designated thresholds of the sub-categories within each category.

C.3 Definition of proficiency levels for SDG thematic indicator 4.7.5

The thematic indicator 4.7.5 measures the percentage of 15-year old students showing proficiency in knowledge of environmental science and geoscience. Because of its similarity with indicator 4.7.4, this indicator shares the same political and practical challenges. Therefore, the solutions that we offer in this report are similar as well.

We consider that, given 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 utilising the methodology developed by IEA in this study (see Figure 2).

An analysis of the science achievement proficiency scale and the descriptions of its contents suggests that it would be possible to adapt the existing scale for the purposes of indicator 4.7.5. There is, however, an important amount of work needed to accomplish this task. For example, the constructs or key concepts identified in the mapping exercise would need to be scaled using the same methodology used in TIMSS to compute indices for each of the categories in the content framework (i.e. Physical systems, Living systems, Earth and space systems). Then, the same procedure followed to establish the TIMSS science achievement scale (i.e. scale anchoring) would need to be followed for each of the categories (see Martin et al., 2016, chapter 14).

¹⁴ In this case it would not be possible to construct a single scale for the whole category because it is very unlikely that a single, uni-dimensional scale can be computed with all the constructs and/or items identified as matching each category.

The specific level or benchmark to be considered to reflect “proficiency” is to be decided by the stakeholders involved in the process of developing an SDG measurement strategy, but having an achievement proficiency scale would offer a concrete framework to do so. For example, if for the category Living Systems, “proficiency” level was to be considered that the “students demonstrate basic knowledge and understanding of practical situations related to Living Systems”, proficiency in knowledge of issues relating to Living Systems could be established at the intermediate benchmark of the achievement scale.

To provide an approach to reporting the socio-emotional and behavioural dimensions of the indicator 4.7.5 analogous to the cognitive achievement scale, a similar method would need to be followed. However, in contrast to indicator 4.7.4, in this case, all the content framework sub-categories are covered by a single construct from TIMSS. This means that the indices to measure each of these sub-categories are already constructed and included in the public TIMSS dataset. It also means that these indices have already been divided into high, middle, and low regions and that the content-referenced interpretation for these regions has been established and is available in the TIMSS public documentation (Martin et al., 2016).

The final step would then be to compute a score for each of the categories identified in the content framework. This could be the average or the proportion of the students reaching the designated thresholds of the sub-categories within each category.

Figure 2. TIMSS science achievement scale

● Advanced International Benchmark

625 *Students apply knowledge and understanding of scientific processes and relationships and show some knowledge of the process of scientific inquiry.* Students communicate their understanding of characteristics and life processes of organisms, reproduction and development, ecosystems and organisms' interactions with the environment, and factors relating to human health. They demonstrate understanding of properties of light and relationships among physical properties of materials, apply and communicate their understanding of electricity and energy in practical contexts, and demonstrate an understanding of magnetic and gravitational forces and motion. Students communicate their understanding of the solar system and of Earth's structure, physical characteristics, resources, processes, cycles, and history. They have a beginning ability to interpret results in the context of a simple experiment, reason and draw conclusions from descriptions and diagrams, and evaluate and support an argument.

○ High International Benchmark

550 *Students apply their knowledge and understanding of the sciences to explain phenomena in everyday and abstract contexts.* Students demonstrate some understanding of plant and animal structure, life processes, life cycles, and reproduction. They also demonstrate some understanding of ecosystems and organisms' interactions with their environment, including understanding of human responses to outside conditions and activities. Students demonstrate understanding of some properties of matter, electricity and energy, and magnetic and gravitational forces and motion. They show some knowledge of the solar system, and of Earth's physical characteristics, processes, and resources. Students demonstrate elementary knowledge and skills related to scientific inquiry. They compare, contrast, and make simple inferences, and provide brief descriptive responses combining knowledge of science concepts with information from both everyday and abstract contexts.

● Intermediate International Benchmark

475 *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 the 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.

○ Low International Benchmark

400 *Students show some elementary knowledge of life, physical, and earth sciences.* Students demonstrate knowledge of some simple facts related to human health, ecosystems, and the behavioral and physical characteristics of animals. They also demonstrate some basic knowledge of energy and the physical properties of matter. Students interpret simple diagrams, complete simple tables, and provide short written responses to questions requiring factual information.

Conclusions and recommendations

The aim of this document was to support the development of a measurement strategy for SDG Global Indicator 4.7.1 and Thematic Indicators 4.7.4 and 4.7.5 using International Large-Scale Assessments (ILSAs) in Education:

- 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.
- 4.7.4 Percentage of students by age group (or education level) showing adequate understanding of issues relating to global citizenship and sustainability.
- 4.7.5 Percentage of 15-year-old students showing proficiency in knowledge of environmental science and geoscience.

Overview of the report

In a first step, the study identified a global content framework for the three indicators based on the existing mapping exercises (see section A). The global content framework for the three indicators was based on the extensive work already conducted by UNESCO for defining and operationalizing GCED and ESD; it adopted the definitions and operationalization proposed in recent documents (e.g. Hoskins, 2016; IBE, 2016; Sandoval-Hernández & Miranda, 2018; UIS, 2017; UNESCO, 2012a, 2012b, 2013, 2014, 2015). We acknowledge that currently there is neither a clear definition nor universal agreement in how to define or operationalize these concepts; nonetheless, we consider that it is possible to identify a set of guiding principles and themes within GCED and ESD. Some adaptations were, however, necessary (see section A for details). Moreover, guided by the UNESCO's recommendations (UNESCO, 2012a, 2012b, 2013, 2014, 2015) and supplemented by the glossary of curriculum terminology (IBE, 2013) and the UIS Glossary, we defined not only GCED and ESD but also what is going to be understood by national education policies, curricula, teacher education and student assessment. Furthermore, based on the same references, we introduced the distinction (and definitions) between intended curriculum, implemented curriculum and attained curriculum. We concluded that, in the current UNESCO operationalizations, SDG 4.7.1 is mainly concerned with intended curriculum (e.g. formal curricular guidelines) and SDGs 4.7.4 and SDG 4.7.5 are covering attained curriculum (e.g. student outcomes of learning). We further noted that increased coverage for SDG 4.7.1 could be envisioned if an implemented curriculum approach were considered (e.g. actual teaching and learning activities taking place in schools).

In a second step, this study evaluated the extent to which the different concepts contained in the content framework can be measured with the instruments and procedures of existing ILSAs (see section B). We reviewed several sources of information from ILSAs with the following criteria in mind: the assessment framework should (at least partially) refer to the concepts relevant to SDG 4.7.1, the instruments should provide sufficient information on as many of the aspects/concepts identified by the global content framework as possible, and they should potentially allow long-term monitoring. In this exercise, we identified the ICCS 2016 study as the most valuable source of information for SDG 4.7.1 and SDG 4.7.4 and the TIMSS study as the most informative for SDG 4.7.5. These studies were chosen due to their specific

conceptual frameworks that showed the highest coverage of the topics relevant to the SDGs, as well as their high potential to inform long-term monitoring. Examples of the framework coverage, instruments, scales and items were provided in connection to the aspects covered by the global content framework and were discussed both in terms of advantages and limitations. The main outcomes of this exercise were: a) stressing that these measures can provide high coverage for the SDG's content but they are only proxy measures and some aspects could have a better coverage; b) these indicators (both in ICCS and TIMSS) are only representative for the target grade 8. Please consult section B for details.

In a third step, the document presented a proposal to define proficiency levels for each of the indicators based on definitions from the same ILSAs (see section C). In this section, we proposed different coding strategies for the potential indicators and we stressed the opportunities and limitations inherent to such decisions. The overall outcomes of this exercise highlighted the following issues: a) we have to keep in mind that all the information provided concerns the surveys' target grade 8; b) if the current proposal should be adopted, the information should be reviewed by the main stakeholders to determine the importance of the indicators, their level of "proficiency" and/or "adequacy" as well as their value (weight) for different scores; c) attention should be given to aligning reporting to IEA current reporting (e.g. UNESCO indicators for cognitive and socio-emotional and behavioral dimensions under SGD 4.7.4 and SGD 4.7.5 should be developed in line with existing IEA procedures), d) these responses are likely to be influenced by cultural differences (e.g. priorities for GCED and ESD at different levels of education; response styles etc.) c) country coverage could be improved (especially in the case of ICCS) to have a better picture of different regions around the world (see also Hoskins, 2016).

Conclusions, limitations and suggestions for developing a measurement strategy

The current analysis suggests that the items, scales and potential indicators (scores) based on the ICCS 2016 and TIMSS (illustrated in Sections B and C) could be considered for inclusion in current reporting. These studies are certainly well suited for providing (at least a proxy) measurement of all SDGs analyzed here. They provide high coverage for the GCED and ESD themes, they incorporate these topics naturally in their frameworks, they collect the same data consistently and allow long-term monitoring, and they have high quality data quality assurance mechanisms in place (ensuring data accuracy, validity and comparability).

Nevertheless, some aspects must be kept in mind when considering this proposal and its implications for further reporting:

- a) All available ILSA's will share some limitations: the data is confined to a specific level of education or student population (e.g. target grade 8 for ICCS & TIMSS; 15-years old students in a country for PISA). The conceptual framework of each study is pre-set on some overall theoretical framework and objectives identified a-priori (i.e. to UNESCO's framework) by the international organization (e.g. IEA, OECD) and the participating countries; therefore, all exercises to identify relevant indicators for secondary purposes are constrained by the original conceptual framework and its specific operationalization. Countries or regions in the world have different needs and rhythms in terms of education development for their citizens (e.g. GCED and ESD themes may be represented at different levels of education in different degrees depending on education policy priorities). Country coverage depends on policy priorities and economic capacity (e.g.

countries may prioritize budgets for ILSAs in terms of national education policy needs and capacity to cover expenses). Finally, responses (especially for student, teachers and school principals data) may be influenced by response styles (e.g. social desirability).

b) In the current exercise, it is important to stress that both ICCS and TIMSS are surveying grade 8 students in the participating countries. The implication of this is that the data reported will mainly refer to grade 8 students in each of the participating countries. For example, SDG 4.7.1 a “global indicator” that, in principle, should cover all levels of education, would only be covered for this level of education (secondary education/grade 8); it may not be relevant for other target grades or levels of education (e.g. primary education or cross-curricular & cross-level approaches in some of the countries). Another example is the case of SDGs 4.7.4 and 4.7.5 where “adequate understanding” and/or “proficiency” levels are representative only for the 8th graders in each country.

c) The information, scales, items and potential scores for the SDG’s identified here are constrained by the conceptual frameworks of ICCS and TIMSS. While there is a high level of coverage, the content/topics covered is never complete. For example, in the case of SDG 4.7.1, the mainstreaming of the GCED and ESD themes in national education policies, teacher education and student assessments are confined to the ICCS framework that considers the GCED and ESD concepts and topics under the umbrella term of civic and citizenship education (CCE). In the case of SDG 4.7.4, the cognitive components may be less represented as opposed to the socio-emotional and behavioral dimensions.

If the current proposal is of interest, then we foresee the following practical steps forward:

a) A stakeholder consultation regarding the content of the current proposal with a focus on both themes and items to be represented as well as their substantive importance (weight) for scoring.

b) A consultation with the IEA regarding an improved convergence in aims. This could concern increasing the coverage of GCED and ESD themes in IEA’s instruments, as well as the extension of data collection to other educational levels (particularly for indicator 4.7.1). Additionally, this consultation should include the incorporation of potential UNESCO indicators in current IEA data processing procedures (an aspect particularly important for the computation of the SDG 4.7.4 and SDG 4.7.5 cognitive aspects, as the items suggested to compute these indicators are currently not publicly released by the IEA).

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Appendix 1. Information regarding the development and implementation of the ICCS 2016 national contexts survey (NCS)

Source: ICCS 2016 Technical report, Schulz, Carstens, Losito, Fraillon, 2018, pp. 30-32

“The development, coordination, analyses, verification and reporting of the national contexts survey was coordinated by ICCS researchers at the international study, and the development process was conducted in liaison with partner institutions and in cooperation with national research coordinators (NRCs) from participating countries. Staff at the IEA in Hamburg were responsible for the implementation of this data collection as an online survey completed by national centers and drawing on available expertise in their countries.”

The ICCS 2016 National Contexts Survey was designed to systematically collect those relevant data and information at the country- or system-level that were not readily available from published sources. The scope of the questions was restricted to more factual aspects.

The questions covered contents such as: a) Education system (background and structure of the education system); b) Civic and citizenship education in the curriculum (education policies, civic and citizenship education at school and at the target grade, current reforms and debates); c) Teachers and teacher education (general structure, teacher education for civic and citizenship education, in-service teacher education for civic and citizenship education); and d) Assessments and quality assurance.

The content of the questions was selected using several criteria such as: a) relevance with regard to the ICCS assessment framework; b) additional value in relation to information about national contexts already in the public domain; c) appropriateness for the national contexts in participating countries; and d) validity in terms of comparability, analysis and reporting.

The respondents were national research coordinators (NRCs) from countries participating in ICCS 2016. They were asked to consult a wider array of reference documents (particularly education policy documents) before answering the questions. Response formats were mainly structured (“Yes” and “No” options) but NRCs had opportunities to provide open-ended responses for clarification and were able to participate in setting up the content of the survey by providing feedback on the appropriateness, completeness and relevance of questions.

The survey was administered online after the respective main ICCS 2016 data collection from students, teachers, and schools took place in each country. The online data received by the ICCS 2016 international study center from each of the 24 participating countries were thoroughly checked for consistency and plausibility. National centers were invited to review draft tables, and corrections were applied where appropriate following feedback from participating countries.

Appendix 2. Selected questions and items ICCS 2016 National context survey

GCED and ESD in policy, curriculum, teacher education and student assessment

Source: ICCS 2016 National context survey

Exhibit 1 TAGS: GCED in POLICY, mainstreaming of GCED in legal frameworks (official curricula)

Q13b Please describe how civic and citizenship education is formally implemented at lower-secondary education (ISCED 2).
(Please tick one box on each line and provide further descriptions where indicated.)

Lower-secondary education (ISCED 2)

(Please write original name of educational level and its English translation below)

Yes 1 No 2

a) Is civic and citizenship included as part of the formal curriculum?

Exhibit 2a TAGS: GCED & ESD in CURRICULUM, mainstreaming of GCED in curricula, TOPICS covered by curricula, secondary education/ICCS 2016 target grade.

Q16 Are the following topics included in the curriculum at the target grade?
(Please tick one box on each line.)

Yes 1 No 2

- a) Human rights
- d) The environment and environmental sustainability
- e) Emigration and immigration
- f) Equal opportunities for men and women
- k) Conflict resolution

Exhibit 3 TAGS: GCED in TEACHER EDUCATION, mainstreaming of GCED in initial and continuing professional development, secondary education/ICCS 2016 target grade.

Q24 Is civic and citizenship education covered as mandatory part of preservice/ initial teacher education for the following groups of target grade teachers?
(Please tick one box on each line.)

Yes 1 No 2

- a) Specialist teachers of civic and citizenship education
- b) Teachers of subjects related to civic and citizenship education (e.g. history, geography, social studies)
- c) Teachers of subjects not related to civic and citizenship education

(e.g. mathematics, science)

Please provide references to relevant documents.

Q25 Is in-service, continuing education or professional development for civic and citizenship education offered to the following groups of target grade teachers?

(Please tick one box on each line.)

Yes 1 No 2

- a) Specialist teachers of civic and citizenship education
- b) Teachers of subjects related to civic and citizenship education (e.g. history, geography, social studies)
- c) Teachers of subjects not related to civic and citizenship education (e.g. mathematics, science)

Please provide references to relevant documents.

Exhibit 4 TAGS: GCED in STUDENT ASSESSMENT, mainstreaming of GCED in student assessment, secondary education/ICCS 2016 target grade.

Q27 Are students in the target grade expected to be formally assessed with regard to learning outcomes of civic and citizenship education?

(Please tick one box only.)

Yes 1 No 2

If you answered 'yes', please describe the methods used for these formal assessments: _____

Appendix 3. Further potential sources of information for SDG 4.7.1. Implemented curriculum perspective

Example 1 TAGS: ESD in Curriculum, mainstreaming of GCED in curriculum, learning activities, secondary education/ICCS 2016 target grade.

Source: School questionnaire

Q9 To what extent are the following practices implemented at this school?

(Please tick only one box in each row.)

To a large extent 1

To a moderate extent 2

To a small extent 3

Not at all 4

a) Differential waste collection.

b) Waste reduction (e.g. <encouraging waste-free lunches, limiting the use of plastic disposable products>).

c) Purchasing of environmentally friendly items (e.g. <recycled paper for printing, biodegradable cutlery and dishes>).

d) Energy-saving practices

e) Posters to encourage students' environmental-friendly behaviours.

Example 2 TAGS: ESD in Curriculum, mainstreaming of GCED in curriculum, Curricular objectives, secondary education/ICCS 2016 target grade.

Source: School questionnaire but items also present in the Teacher questionnaires and similar content somewhat covered in the National Context Survey

Q16 What do you consider the most important aims of civic and citizenship education at school?

Indicate the three aims that in your opinion ought to be the most important by ticking the three appropriate boxes.

a) Promoting knowledge of social, political and civic institutions

b) Promoting respect for and safeguard of the environment

c) Promoting the capacity to defend one's own point of view

d) Developing students' skills and competencies in conflict resolution

e) Promoting knowledge of citizens' rights and responsibilities

f) Promoting students' participation in the <local community>

g) Promoting students' critical and independent thinking

h) Promoting students' participation in school life

i) Supporting the development of effective strategies to reduce racism

j) Preparing students for future political engagement