SDG 4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

METADATA

Target 4.7 By 2030, 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

4.7.3 Extent to which green policy intentions are mainstreamed in curriculum documents.

Definition

Greening education involves, first and foremost, the greening of education policy and the curriculum. The integration of green content is expected to occur in all subject curricula and at all education levels, particularly but not limited to, primary and secondary education. This greening process represents a critical step in a comprehensive rethinking of the purposes, contents, and structured experiences of formal schooling. Inclusion of green content in the curriculum is intended to influence teaching and learning processes by emphasizing themes and topics related to environment, sustainability, climate change, and biodiversity. Although inclusion of green topics in the curriculum does not fully determine if and how these topics are implemented in formal education institutions, a curriculum and policy indicator represents an informative input measure that can be related to outcome measures such as student knowledge, attitudes, values, and/or action. The mainstreaming of green content in the curriculum can also be considered a marker of countries fulfilling their greening education commitments as set out in the SDGs (SDG Targets 4.7, 13.3, and 12.8) and the UN Transforming Education Summit. Finally, it is related to Article 6 in the UN Framework Convention on Climate Change (1992), which calls on parties to expand education and training that enable citizens to contribute to climate mitigation and adaptation.

The GCI focuses on three basic elements or 'themes' of greening the curriculum at primary and secondary levels – namely the inclusion of: (1) Environment/Sustainability, (2) Climate Change, and (3) Biodiversity. The GCI conceptualizes Environment/Sustainability as a 'core' theme under which the themes of Climate Change and Biodiversity are nested. The GCI weights Environment/Sustainability more heavily given its comprehensive scope, since it typically encompasses Climate Change and Biodiversity content. Climate Change and Biodiversity are included as distinct areas of focus not only to recognize and encourage inclusion of these two specific environmental issues, but also given their centrality to planetary sustainability (UN, 1992; UNFCCC, 2015).

The GCI measures the extent to which the three elements of Environment/Sustainability, Climate Change, and Biodiversity are being mainstreamed in the curriculum. Specifically, the GCI estimates the inclusion of green content in National Curriculum Frameworks (NCFs) since they provide vital information about overarching education priorities, and in the science and social science subjects taught in three grade levels of primary and secondary education: grades 3, 6, and 9, since these describe how and which topics and themes should be taught in classrooms. Science and social science subjects are included since they are viewed as areas of the curriculum in which green content is most likely to be found. Grades 3, 6, and 9 represent the typical range of compulsory schooling in most countries (primary and lower secondary education). In most countries, the authorship of these two document types differs: NCFs are prepared and authorized by high level officials in ministries of education, whereas subject curricula are typically prepared in ministry curriculum departments, drawing on the expertise of subject specialists.

Aligning the GCI with the Greening Education Partnership Curriculum Guidance
The Greening Education Partnership (GEP) is an open global platform launched in conjunction with the UN Transforming Education Summit in 2022. The GEP takes "a whole-of-system approach to support countries to tackle the climate crisis by harnessing the critical role of education" and seeks to "prepare every learner with the knowledge, skills, values, and attitudes needed to tackle climate change and to promote sustainable development" (UNESCO, n.d.). As of November 2024, GEP members included 96 UNESCO Member States and over 1,600 organizational stakeholders including intergovernmental organizations, civil society, youth, academia, and the private sector.

The GEP is organized around four 'pillars' of transformative education: greening schools, greening curriculum, greening teacher training and education system capacities, and greening communities. To support the greening curriculum pillar's goal of having 90% of countries green their curriculum by 2030, UNESCO launched an extensive curriculum guidance document in July 2024 (UNESCO, 2024b). This publication outlines general strategies; key concepts, topics, and learning outcomes; and implementation advice for greening education systems for learners aged 5 to 18+. The greening curriculum guidance document focuses on six key concepts – namely, climate science, ecosystems and biodiversity, climate justice, resilience-building, post-carbon economies, and sustainable lifestyles – as part of a 'transformational' Education for Sustainable Development paradigm (UNESCO, 2024b, p. 28). The current GCI is relevant to the GEP curriculum guidance document since many of the green keywords utilized in its analyses (discussed below) are aligned with the above six concepts.

Purpose

The Greening Curriculum Indicator (GCI) explicitly addresses the mandate given to the UNESCO Institute for Statistics (UIS) and the Global Education Monitoring (GEM) Report to monitor country efforts to implement Initiative 1 – *Greening Education - to get every learner climate ready* – one of seven global initiatives emerging from the Transforming Education Summit. The GCI focuses on the curriculum and policy dimensions of greening education and is based on content analyses of two types of curriculum documents: first, National Curriculum Frameworks (NCFs), a document type that overviews curricular priorities, structures, and guidelines; and second, science and social science subject curricula in grades 3, 6, and 9, which provide guidance to teachers about course content and pedagogy. NCFs typically focus on primary and secondary education, though in some cases, they also focus on pre-primary education, technical-vocational education and training, and/or post-secondary education.

Calculation method

This section describes methodological aspects of the Greening Curriculum Indicator. It starts by describing which official curriculum documents were compiled and how. It continues by defining the criteria used to determine which countries to include in the analysis as well as the green keywords used to determine the extent to which countries prioritize green content in their official curriculum. The section ends by describing the steps taken in calculating each country's GCI score.

Definitions of Document Types

To measure the extent to which green content is integrated in the official intended curriculum of primary and (lower) secondary education, two types of documents are analysed to create a country's GCI score: 1) **National Curriculum Frameworks** and 2) **subject curricula documents** from science and social science subjects taught in grades 3, 6, and 9. The terms curriculum or syllabus here should be distinguished from related terms such as textbook, lesson plan, and teaching guidelines.

National Curriculum Frameworks

NCFs are defined as national-level policy documents that overview a country's educational goals and priorities and set forth key parameters of the country's official intended curriculum. NCFs are written and approved by the relevant ministry of education or other officially designated body. A comprehensive NCF: 1) delineates the aims of the curriculum at various stages of schooling; 2) explains the educational philosophy underlying the curriculum and approaches to teaching, learning, and assessment that align with that philosophy; 3) describes curricular structures; 4) assigns names to subject/learning areas; 5) allocates time to each subject (or group of subjects) in each grade level (or set of grades); 6) provides guidelines to curriculum developers, teacher trainers, and textbook writers; 7) prescribes curricular standards and mechanisms for inspection and monitoring; and 8) refers to learning assessments to be conducted (UNESCO-IBE, 2017a; UNESCO-IBE, 2017b).

Subject Curricula

Subject curricula or subject syllabi are defined as subject- and grade-specific documents that include most or all of the following information: 1) a general rationale for the teaching of the subject; 2) the intended aims and learning outcomes; 3) clearly defined content areas (topics and themes) to be included in the teaching of each subject; and 4) ideally, a weekly, monthly, or yearly

timetable allocating instructional time to each topic/subject, pedagogical considerations, and possibly assessment guidelines. The name given to such documents varies by language – for example, "programme" (French), "lehrplan" (German), "programma" (Italian), "plan de estudios" (Spanish) and "almanhaj" (Arabic) – and may have slightly different connotations. There are no international guidelines for subject curricula, partly because they reflect national traditions in the development and implementation of the official curriculum, the extent of teacher and school autonomy, and patterns of pre-service and in-service teacher training.

Document Collection

National Curriculum Frameworks

NCF documents are identified by searching ministry of education websites, as well as databases such as UNESCO IIEP Planipolis, UNESCO International Institute for Educational Planning (IIEP), Siteal, UNESCO Regional Comparative and Explanatory Study (ERCE), Eurydice, Organization for Economic Cooperation and Development (OECD) Policy Outlook, and the Educational Media Research (Edumeres), as well as consulting country experts.

To be considered an NCF for the purposes of the GCI, the document should:

- Be written by the ministry of education or other official designated body.
- Cover primary, lower secondary, or upper secondary levels of formal education (categories 1, 2, and 3 according to the International Standard Classification of Education or ISCED).[1]
- Have a title or opening matter that describes the document as a National Curriculum Framework.
- Include content that aligns with the sections outlined in the document definitions above.

In cases where an NCF matching the above criteria is not identified, other documents containing similar content to an NCF are considered for inclusion. For example:

- The introductory or front matter of document(s) specifying the content of subject curricula similarly to an NCF.
- Laws or regulations passed by legislative or executive bodies that specify curricular structures and contents of a national education system along the lines of an NCF.
- Official websites of national governments or subnational political units that present in a similar manner to an NCF.

Subject Curricula

Subject curricula are included for subjects in two broad **knowledge domains: science and social science**. Curricula for up to four subjects in each knowledge domain (thus up to eight subjects in total) are included at each grade level (3, 6, and 9) in each country or sub-national jurisdiction. Table 1 lists the typical subjects found in each knowledge domain internationally. Many countries organize instruction in a single general science and/or social science subject (more common in grades 3 and 6), rather than numerous specialized subjects (more common in grade 9). Some

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[1] See https://uis.unesco.org/en/topic/international-standard-classification-education-isced

countries teach interdisciplinary subjects on environmental education (EE) or education for sustainable development (ESD) or special hybrid subjects that combine science and social science content. Such interdisciplinary or hybrid subjects are included among the up to eight subjects per grade level.

Subject curricula documents are identified through a range of sources, including through manually reviewing ministry of education websites and searching archives of recent curriculum studies. National Commissions for UNESCO also provided subject curricula following a request by the UNESCO International Bureau of Education. In cases where these methods do not yield the relevant subject curricula, additional documents are collected through consultation with country education experts.

Table 1: List of typical science, social science and EE/ESD subjects included in GCI calculations

Science Subjects	Social Science Subjects	EE/ESD subjects
• General Science • Applied Science / Technology • Earth Science • Life Science • Physical Science	• General Social Science • Geography • History • Civics/Citizenship • Economics • Religious, Moral, and Philosophy • Cultural and Art Studies	• Environmental Education • Environmental Education / Education for Sustainable Development • Environmental and Outdoor Education • Sustainability

Table note. The number of science subjects never exceeded four subjects in any country, so all science subjects were collected for the countries included in the sample. Any curricula related to EE or ESD were also collected. In total, 17 countries had EE/ESD specific curricula.

Document Preparation
All collected documents are added to a single database in a standardized fashion. Documents are downloaded if found online and converted to PDF if in another format. In many cases subject curricula are part of a larger document, in which case, relevant subject- and grade-specific material are extracted into separate documents. Documents in the database are named using the following protocol:
"country_state/province_documenttype_region_year_language_grade_knowledgedomain"

Information about each document is stored in a database (one row per document), including document title, year of publication, subject, author, source, and language.

For documents in languages for which there are fewer than three documents in that language (Burmese, Norwegian, Swedish, and Urdu), the documents are machine translated into English using Google Translate.

Criteria for Country Inclusion
As previously noted, the GCI aligns with commitments made by parties to the UN Framework Convention on Climate Change (UN, 1992), by UN Member States in the 2030 Agenda for Sustainable Development (UN, 2015), and by attendees to the UN Transforming Education Summit

(UN, 2022; 2023). As such, the focus of document compilation is all 193 UN Member States as well as 3 additional entities (i.e., Cook Islands, Niue, and Palestine), which are parties to the UNFCCC.

Among these 196 possible countries, inclusion in the GCI is dependent on whether a sufficiently complete set of documents for that country has been compiled. A sufficient set of documents means having at least three of the following four types of documents that meet the previously outlined criteria:

- Grade 3 subject curricula
- Grade 6 subject curricula
- Grade 9 subject curricula
- National Curriculum Framework (NCF)

A special notation (i.e., "Qualifier of Data-Partial Data") is placed in the database to indicate cases where the GCI was calculated based on three of the four document types. When missing document types are obtained, a revised GCI score based on a complete set of document types is calculated for the bi-annual data releases.

Keyword Selection and Analysis

The GCI measures the inclusion of green content in the four document types by counting the presence of thirteen keywords corresponding to the three themes of Environment/Sustainability, Climate Change, and Biodiversity. For each theme, 4-5 keywords are selected that: 1) best represent the theme, 2) can be translated into all relevant languages, and 3) are sufficiently prevalent in the analysed documents to provide data for measuring components of the GCI (see Table 2). Additional sources such as recent UNESCO studies of greening education and the GEP curriculum guidance are also used to identify relevant green keywords.

Each keyword includes its plural and singular as well as the many forms the word may take depending on the language.[2] Some languages and/or countries employ distinctive language/culture-specific keywords to capture a theme. Thus, each theme includes space for a culture- or language-specific keyword to be added, if appropriate.[3] The keywords and their translations into 40 languages are reviewed and validated by native speaking experts who are familiar with greening education concepts.

Table 2. Green keywords organized by theme

Theme	Keywords		Total # of Keywords
Environment and Sustainability	● environmental* ● sustainability	● greening ● "sustainable development"	4

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[2] Different forms of the word are included only due to genders, definite articles, etc. but not when they change the meaning or part of speech.

[3] For example, in China the phrase 'ecological civilization' is now being used much more frequently than 'sustainable development' or 'environmental.' In Japan, the term 'sustainable societies' is becoming more prevalent than the term 'sustainable development.' At this point in time, no culture- or language-specific keywords are included in the GCI.

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Climate change	● "climate change" ● "global warming" ● "greenhouse gas*"	● "climate justice" ● "renewable energy"	5
Biodiversity	● biodiversity ● ecosystem*	● extinction* ● invasive species	4
Total number of keywords			13

A Python-based application is used to bulk process text files and identify keywords in documents in all the required languages. To be read by the Python application, all the text documents are converted to UTF-8 text format and stored in a local folder. The Python application also requires a two-column spreadsheet with columns for "File Name" and "Language" and a second spreadsheet with columns for "Keyword" and the keyword's "Language." These files and the folder location are then loaded into the Python application. The application uses the language file to determine which column from the keyword file to utilize in searching for keywords for each text file. The application then counts relevant keywords in every document (NCF and subject curricula) in the specified language. After completing the keyword search processing, the application outputs a spreadsheet file that contains a row for each curriculum document and columns for every keyword.[4] This output file becomes the raw data used in the calculation of the GCI.

Calculation of the Greening Curriculum Indicator
After the prevalence of each keyword in each document is determined, keyword counts are compiled into an output spreadsheet which is then used to calculate a country's GCI score. The following specific steps are taken to calculate a country's GCI score:

Phase 1) Development of Standardized Keyword Counts
The analysis of the green content of each country's NCFs and subject curricula is done at the country level.

● For the NCF and each grade level (3, 6, and 9), the frequency of keywords belonging to the themes of Environment/Sustainability, Climate Change, and Biodiversity are calculated by summing up the counts of the keywords.
● To account for varying document lengths, the number of keywords is standardized for each theme by dividing the keywords counts in that country's theme with the total number of words in the country's documents.
● This standardized number is then multiplied by 1 million to transform the result into a number that is more easily interpreted (i.e., not a very small decimal). The result is a keyword count per

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[4] To determine the accuracy of the counts generated by the Python program, a validation exercise was carried out in October 2024 by sampling 30 documents in English, Spanish, Arabic, and French, the four most prevalent languages. A three-way comparison of results from NVivo (the software used for all related UNESCO consultancies), Python, and manual counts identified several minor issues (e.g., keywords split across lines or the lack of a definite article in the Arabic keyword list), which were immediately corrected in the Python program and the keyword list. Since then, the Python program has been reviewed by several experts and undergone further refinements to ensure its counting accuracy is comparable to NVivo and manual counting.

million words for each theme at each grade level and NCF for each country. The standardization calculation is as follows:

- ○ 1,000,000*(Keywords in that Theme for that country) / (Total words in the Documents for that country)

Phase 2) Transformation of Standardized Keyword Counts into an Ordinal Scale

The distribution of these standardized numbers presents a statistical challenge since it is both zero bounded[5] and has a long tail.[6]

- To create a more normal distribution, the standardized numbers are transformed into a ordinal scale ranging from 0 to 10 in the following way:
  - ○ If there are no keywords, the score is 0, otherwise it ranges from 1 to 10 using a ½ life logarithmic transformation.[7]
  - ○ For the Environment/Sustainability 'core' theme, the maximum score of 10 is achieved with 10,000 standardized keywords. The following formulas are used:
    - ■ >10,000 standardized keywords are assigned a score of 10,
    - ■ <=20 standardized keywords are assigned a score of 1,
    - ■ 0 standardized keywords are assigned a score of 0,
    - ■ Otherwise, 10-log.5(#/10,000)
    - ■ Result multiplied by 10
  - ○ For the Climate Change and Biodiversity themes, the maximum score of 10 is achieved with 5,000 standardized keywords, given that these keywords are used less commonly. The following formulas are used:
    - ■ >5,000 standardized keywords are assigned a score of 10,
    - ■ <=10 standardized keywords are assigned a score of 1,
    - ■ 0 standardized keywords are assigned a score of 0,
    - ■ Otherwise, 10-log.5(#/5,000)
    - ■ Result multiplied by 10

Phase 3) Calculating GCIs for Federated Countries

To calculate the GCI for federated countries (e.g., Australia, Switzerland, Canada, and the UK), all of the above mentioned steps are carried out for each sub-national jurisdiction, which results in a number of (sub-national) GCIs. The sub-national GCI scores for the country are then averaged into

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[5] While there are many documents lacking any keywords related to Environment/Sustainability, Climate Change and Biodiversity, there are no documents with a negative number of keywords. Such a situation represents a zero-bounded distribution and creates a lopsided and non-normal distribution.

[6] While more than half the document types have less than 120 standardized keywords in a theme, they range to over 9,000 (75+ times as much as the median). Log transformations are conceptually useful when dealing with such data. For example, going from 0 to 50 standardized keywords is more significant than going from 1000 to 1050 standardized keywords.

[7] This means that for each time the standardized counts are halved, the score goes down by 1. So, for example, if 10,000 standardized references is a score of 10, 5,000 is a score of 9, 2,500 is a score of 8, and so on.

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a national GCI score. The data for all federated countries are then added to the dataset produced in Phase 1.

Phase 4) Final Calculation of the GCI
At this point, each country has either three or four document-specific scores (ranging from 0 to 10) for each of the three themes (i.e., 9 or 12 total scores, since countries are included if they have at least 3 of the 4 main document types of NCF, grade 3 subject curricula, grade 6 subject curricula, and grade 9 subject curricula).

● Within each of the Environment/Sustainability, Climate Change, and Biodiversity themes, the three grade level scores and the NCF score are averaged together (i.e., each contributes ¼ of the total score per theme in a country). For countries with only three document types, the same procedure is done but each document score contributes ⅓ of the total theme-focused score.
● A single overall GCI score is now calculated based on a weighted mean, with the Environment/Sustainability core theme weighted 50% and the Climate Change and Biodiversity themes each weighted at 25%.

Disaggregation
The indicator cannot be disaggregated. However, it is possible to report the average percentage of the maximum score for that category, which can be reported by keyword group, grade and knowledge domain. Such reporting contains important policy messages -- for instance, it was found that countries are less likely to include keywords related to biodiversity and climate change (than for the more general environment/sustainability cluster), in grades 3 and 6 (than in grade 9), and in the social sciences (than in in sciences).

Data sources
Regarding greening, a database of over 1,700 curriculum documents has been compiled, in the following categories:

1) National curriculum frameworks (or similar documents) or, when unavailable, education sector plans.
2) Science and social science subject curricula (syllabi) for grade 3.
3) Science and social science subject curricula (syllabi) for grade 6.
4) Science and social science subject curricula (syllabi) for grade 9.

A search in the curriculum documents for the 35 environment, sustainability, and climate change keywords was carried out in 30 languages. All keywords were initially translated and then validated by language proficient experts. The keyword searches were carried out in 24 languages using NVivo 12, a qualitative data software management software. In 6 languages, which could not be read by NVivo, manual searches of keywords were conducted by trained, language proficient, coders. Altogether NVivo and the manual coders identified over 20,000 green keywords in the two types of curriculum documents: 90% of the keywords were related to environment and sustainability, and 10% to climate change and biodiversity.

In terms of data collection for greening, up to eight science and social science subject curriculum documents were collected at each grade level (3, 6 and 9) in each country or subnational jurisdiction. In some instances, different subnational jurisdictions use the same curricula. Many

countries have a single general science and social science subject for both grades 3 and 6, rather than an array of specialized subjects, which is more common in secondary education. A range of sources were used to collect curricula, including scanning websites and searching archives of recent curriculum studies. National Commissions for UNESCO also provided curricula, following a request by the UNESCO International Bureau of Education. In cases where these methods did not yield the relevant grade 3, 6, or 9 curricula, country experts were consulted. National curriculum frameworks and education sector plan documents were located by searching education ministry websites and databases such as UNESCO IIEP Planipolis, UNESCO IIEP Siteal, UNESCO ERCE, Eurydice, OECD Policy Outlook, and Edumeres, as well as consulting country experts.

Quality assurance
Regarding greening, keywords and their translations were reviewed by native speakers who were also familiar with greening concepts. Documents were reviewed against a set of criteria before being included for analysis. See section "Calculation method" for additional details.