

## Third International Geoscience Education Survey: 2012 – with 2013 updates, 2

*Note 1: We are most grateful to everyone who has contributed to this survey, and has committed considerable time and effort to providing a clear picture of the Earth science education in their own countries.*

*Note 2: Where a country has several states (eg. Germany, India, USA), the updaters have pointed out that, because of variations across their countries, they have done their best to present a national picture, but this often just reflects the situation in some states.*

*Note 3: The survey data has been posted on the International Geoscience Education Organisation website, after minor editing, for all to use. It has also been used to prepare a presentation for the International Geological Congress, Brisbane 2012, and for publication in the International Union of Geological Sciences 'Episodes' magazine, by Chris King.*

*Note 4: The data has been compiled by Chris King, contact details below.*

*Note 5: Where applicable, summaries of the data have been provided at the end of each section.*

### DETAIL OF UPDATERS

Country	Date of latest data update	Latest updater		
		Name	Email address	Other contact details
<b>Argentina</b>	2012	Jose Selles Martinez	pepe@gl.fcen.uba.ar	
<b>Australia</b>	2006	Ian Clark Bronte Nicholls	ian.Clark@unisa.edu.au slab@internode.on.ne	
<b>Bangladesh</b>	2012	Afia Akhtar	afia@agni.com	
<b>Belgium</b>	2006	A. Pissart	pierre.gridelet@cfwb.be	Pierre Gridelet, (geomorphologist, Université de Liège), Inspecteur de Géographie de la Communauté française.
<b>Brazil</b>	2012	Celso Dal Ré Carneiro, Pedro Wagner Gonçalves,	cedrec@ige.unicamp.br pedrog@ige.unicamp.br	Celso Dal Ré Carneiro, IG-Unicamp, Campinas, Brazil. Pedro Wagner Gonçalves, IG-Unicamp, Campinas, Brazil.
<b>Canada</b> Note: This is a composite response for 8 of 13 educational jurisdictions in one country – codes Alberta AB, British Columbia BC, New Brunswick NB, Newfoundland and Labrador NL, North West Territories NT, Ontario ON, Saskatchewan SK, Yukon YT	2013	Oliver Bonham Eileen Van der Flier-Keller	obonham@ccpg.ca fkeller@uvic.ca	
<b>Czech Republic</b>	2006	Petr Pudivítř	puda@seznam.cz	Teacher of physics at Gymnázium Ch. Dopplera, Zborovská 45, 150 00 Praha 5

Country	Date of latest data update	Latest updater		
		Name	Email address	Other contact details
England	2012	Chris King	chris@cjhking.plus.com	Professor of Earth Science Education, Department of Education, Keele University, Keele, Staffs, ST5 5BG 44(0)1784 484437
Estonia	2006	Imbi Henno	imbi.henno@ekk.edu.ee	Chief Expert of Natural and Environmental Science National Examination and Qualification Centre 21 Sakala St, 10141 Tallinn Tel: +372 63 11 080 Fax: +372 64 61 676 Mob: +372 51 75 547
Finland	2012	Mia Kotilainen	mia.kotilainen@helsinki.fi	University of Helsinki, Department of Geosciences and Geography, PO Box 64, 00014 University of Helsinki, Finland.
France	2013	Jacques Charvet Berenguer Jean-Luc	jacques.charvet@univ-orleans.fr jlbereng@ac-nice.fr	Professor Jacques Charvet Faculty of Sciences Institute of Earth Sciences of Orléans (ISTO) Campus Geosciences - Bldg. ISTE University of Orléans Tel. 02 38 41 70 07 Jean-Luc Berenguer Geosciences and Biology Teacher at International Center of Valbonne (C.I.V)
Germany	2012	Sylke Hlawatsch Dirk Felzmann	kontakt@sylke-hlawatsch.de felzmann@idn.uni-hannover.de	
India	2012	Dr R. Baskar	rbaskargjuhisar@yahoo.com	Department of Environmental Science and Engineering, Guru Jambheshwar University of Science and Technology, Hisar 125001,

Country	Date of latest data update	Latest updater		
		Name	Email address	Other contact details
				Haryana, India. Telefax 0091-1662-278729 Mobile 0091-9416439339
<b>Indonesia</b>	2012	Dwikorita (Rita) Karnawati Hendra Amijaya	dwiko2007@yahoo.co.id hendraamijaya@yahoo.com	Rita - Department of Geological Engineering, Gadjah Mada University, Indonesia. Hendra - Department of Geological Engineering, Gadjah Mada University, Indonesia.
<b>Israel</b>	2012	Nir Orion	nir.orion@weizmann.ac.il	Head of Earth and Environmental Education, Science Teaching Department, Weizmann Institute of Science, Israel.
<b>Italy</b>	2012	Roberto Greco	robertogreco01@yahoo.it	Via J. da Todi, 46 CAP 41100 Modena, Italy.
<b>Japan</b>	2006	Yoshisuke Kumano	edykuma@ipc.shizuoka.ac.jp	Faculty of Education, Shizuoka University, 836 Shizuoka-Shi, Japan.
<b>Korea</b>	2012	Young-Shin Park	Parkyoungshin1968@gmail.com	Assistant Professor, Department of Earth Science Education, Chosun University.
<b>Malawi</b>	2012	Cosmo Ngongondo	cngongondo@chanco.unima.mw	University of Malawi, Chancellor College, Department of Geography and Earth Science, P.O. Box 280, Zomba, Malawi.
<b>New Zealand</b>	2012	Glenn Vallender	ge.vallender@xtra.co.nz or info@edrsr.co.nz	16 Woodham Drive, Ashburton, 7700 NZ .
<b>Norway</b>	2012	Kari Beate Remmen Merethe Frøyland	k.b.remmen@naturfagsenteret.no merethe.froyland@naturfagsenteret.no	
<b>Philippines</b>	2012	Miguel Cerna Cano	jurassic_mike@yahoo.com	Department of Mining Engineering Bicol University Legazpi City, Philippines 4500.
<b>Portugal</b>	2006	Luis Marques	lmarques@dte.ua.pt	
<b>Romania</b>	2006	Popa Mirela Mihaela	mpopa62@yahoo.com	
<b>Russia</b>	2012	Evgeny Nestrov	nestem26@mail.ru	+79213106234
<b>Saudi Arabia</b>	2006	Mohammed As'sad Tawfiq Engr. Ahmad M. Al Attas		P.O. Box 15451, Jeddah 21415.
<b>Scotland</b>	2006	Colin Graham	colin.graham@ed.ac.uk	Geology and Geophysics,

Country	Date of latest data update	Latest updater		
		Name	Email address	Other contact details
		Hamish Ross	hamish.ross@education.ed.ac.uk	Grant Institute, King's Buildings, University of Edinburgh, West Mains Road, Edinburgh, UK.
<b>South Africa</b>	2012	Ian McKay	ian.mckay@wits.ac.za witsgeoutreach@gmail.com	Bernard Price Institute of Palaeontology, School of Geosciences, University of the Witwatersrand, Private Bag X3, Wits, 2050 Tel: 011 717 6665/7 work Fax: 011 403 1423 Cell: 084 500 3902
<b>Spain</b>	2012	Xavier Juan	xjuan@wanadoo.es	IES Sant Quirze, Bages 21, 08192 Sant Quirze, Spain. Tel +34937213144 Fax +347213150
<b>Sri Lanka</b>	2012	Ashvin Wickramasooriya A. Pitawala	awickramasooriya@yahoo.com apitawala@pdn.ac.lk	+94-779406168 +94-776-052847
<b>Taiwan</b>	2012	Chun-Yen Chang	changcy@ntnu.edu.tw	
<b>Trinidad &amp; Tobago</b>	2006	Stacey Edwards	staceyedwards@uwiseismic.com	
<b>Uruguay</b>	2006	Fernando Tabó	secretaria@dinamige.miem.gub.uy	Phone: +5982-2093196 – Fax: +5982- 2094905 www.dinamige.gub.uy
<b>United States</b>	2012	Mary Dowse Sharon Locke	Dowsem@wnmu.edu sharon.locke1@gmail.com	WNMU, PO Box 680, Silver City, NM 88062
<b>34 countries</b>				

## NATIONAL CURRICULUM/STANDARDS

- Does your country have a National Curriculum or National Standards in education that are compulsory across the whole country/region?

Country	National Standard (school level)	Comment
Argentina	Yes	Primary and secondary schools (6 to 17 years old) are compulsory
Australia		There is a national curriculum framework that has Earth and Space as one of the themes from K-12
Bangladesh	No	<p>Bangladesh has defined national earth science or geoscience education standards at the university level of education only. But there is no specific geoscience or earth science curriculum in Pre-College and College level of education, except in geography. Geoscience, especially geology is taught only in three universities out of 51 private and 31 public universities. By definition geoscience is a combination of many sciences such as geology, geography, soil sciences, environmental sciences and so on. Geography is taught at all levels of education but is not compulsory for all students and for all educational institutes. Geography has national education standards. Fundamentals of geosciences such as some topics on geology, soil sciences, environmental sciences, agricultural science etc. are included in the syllabuses of general science and social science at school levels of education. Maths, physics, chemistry, biology and social science are taught as separate subjects in science groups in secondary and higher secondary levels of education, that is in classes of IX – X and classes of XI – XII with students of age ranges 14-15 and 16-17. Among Geoscience subjects, geography is the oldest, and is taught in many universities whilst, very recently, environmental sciences have also been included in the syllabuses of many private universities. Soil Sciences is taught in university and there is one separate university in northern Bangladesh for agricultural sciences. A few years ago another university focusing on agricultural sciences opened in Dhaka.</p> <p>The national science education standards are approved by Department of Public Education Instruction (DPEI) and published by the Bangladesh Text Book Board. Government level Primary and Secondary Schools of education all over Bangladesh follow the same standards and so, there is no variation. But, for English medium schools, there are varieties of standards.</p> <p>In some remote areas and even in some areas in cities, all schools or colleges have no facilities to implement national science standards. In developing countries like Bangladesh, social and economic conditions, low literacy rates, insufficient numbers of trained teachers etc. are the major obstacles to implementing science standards properly. In schools which are well-equipped and have sufficient trained teachers, the implementation of science standards is more satisfactory than in other schools.</p> <p>Being a developing nation, lack of sufficient fund to support development of materials and purchase of supplies, as well as the lack of initiative of concerned persons, are barriers to the implementation of science standards in some institutes.</p>

Country	National Standard (school level)	Comment
<b>Belgium</b> : French part = Communauté française de Belgique = Wallonia and Bruxelles		
<b>Brazil</b>	Yes	The National Curricular Parameters (Parâmetros Curriculares Nacionais, in Portuguese) are compulsory across the whole country. They do not include any nation-wide Earth science or geoscience education standards, but Earth Sciences are spread along with many other topics in disciplines such as Geography or Sciences, at the fundamental level, and a few scientific disciplines at the middle level
<b>Canada</b>	No	Each Province and Territory has jurisdiction over own curricula, however many are consistent with the Pan-Canadian Common Framework of Science Learning Outcomes K-12. Common curricula in groups of provinces/territories e.g. Atlantic Canada region, YT/BC, AB/ NT (10-12).
<b>Czech Republic</b>	Yes	They are compulsory across the whole country.
<b>England</b>	Yes	Compulsory in government maintained schools
<b>Estonia</b>	Yes	
<b>Finland</b>	Yes	Compulsory in all schools and pre-schools. The Finnish education system is composed of nine-year basic education (comprehensive school), preceded by one year of voluntary pre-primary education; upper secondary education, comprising vocational and general education; and higher education, provided by universities and polytechnics.
<b>France</b>	No	
<b>Germany</b>	Yes, but not for Geography; Earth Science is not a school subject	There are Geography Curricula for every Federal State including earth Science topics.
<b>India</b>	No	There is no National Curriculum in India. There are National Standards created and published by the University Grants Commission (for graduate and post-graduate courses), NCERT for School Education. In addition, we have a multiplicity of boards like CBSE, ICSE and State Boards. The prescribed syllabuses are strongly recommended as models for the development of standards; they mostly do closely reflect the National Standards.

Country	National Standard (school level)	Comment
Indonesia	Yes	<p><b>A. the Senior High School</b> (Class 10 – 12) the curriculum is divided into Natural Science and Social Science fields of study. For the Natural Science field of study, the main subjects learned are maths, biology, physics, chemistry, language (Indonesian and English, and may also include additional overseas languages like French, Dutch, German or Arabic), Pancasila (National Ideology and Philosophy), and also minor subjects include geography (this includes Earth sciences) and the local ethnical language, social sciences/ economics and religion. The schools which implement national standards are well-accredited by Government.</p> <p><b>B. the Junior High School</b> (Class 7 to 9), the curriculum is not differentiated between Natural and Social Sciences. The main subjects include maths, physics, biology (no chemistry), national ideology and philosophy, language (Indonesian and English), and also minor subjects such as geography (physical and social), history, economics, religion, local ethnical language.</p> <p><b>C. the Elementary School</b> (Class 1 to 6), the main subjects starting from class 4 to 6 are maths, physics, geography (including Earth sciences and social), history, languages (Indonesian and local ethnical language). Main and minor subjects in all levels are <b>compulsory</b> but more class hours are allocated to the main subjects.</p>
Israel	Yes	
Italy	Yes	<p>In Italy a national curriculum exists for primary school and lower secondary school and just for the lyceum in upper secondary schools. For technical and professional institute upper secondary schools, Italy has curriculum guide lines.</p> <p>Basic documents used in this questionnaire:  <b>For primary and lower secondary school:</b>  D.m. del 31 luglio 2007 <a href="http://archivio.pubblica.istruzione.it/normativa/2007/dm_310707.shtml">http://archivio.pubblica.istruzione.it/normativa/2007/dm_310707.shtml</a>  <a href="http://archivio.pubblica.istruzione.it/normativa/2007/allegati/dir_310707.pdf">http://archivio.pubblica.istruzione.it/normativa/2007/allegati/dir_310707.pdf</a>  (Valid until the 31/08/2012 even D.lgs. 59/2004 Allegato B and C)  <b>For upper secondary school:</b> DPR 15 marzo 2010:</p> <ul style="list-style-type: none"> <li>• For Lyceum: art 2, com.1 and 3; art. 10 com. 3 - Schema di regolamento recante "Indicazioni nazionali riguardanti gli obiettivi specifici di apprendimento concernenti le attività e gli insegnamenti compresi nei piani degli studi previsti per i percorsi liceali di cui all'articolo 10, comma 3, del decreto del Presidente della Repubblica 15 marzo 2010, n. 89, in relazione all'articolo 2, commi 1 e 3, del medesimo regolamento."</li> <li>• For Technical school art.8 com.3: LINEE GUIDA PER IL PASSAGGIO AL NUOVO ORDINAMENTO</li> <li>• For professional institute: art.8, com 6 - ISTITUTI PROFESSIONALI - LINEE GUIDA PER IL PASSAGGIO AL NUOVO ORDINAMENTO</li> </ul>
Japan	Yes	<p>There are general science courses from 3<sup>rd</sup> grade to 9<sup>th</sup> grade and the science course consists of physics, chemistry, biology and Earth science. For 10<sup>th</sup> and 12<sup>th</sup> graders, we offer Earth science I and Earth science II with other science courses (e.g., physics I, physics II, biology II, etc.) so that students can choose from them.</p>

Country	National Standard (school level)	Comment
<b>Korea</b>	Yes	We have a "science" course from 3 <sup>rd</sup> grade to 9 <sup>th</sup> grade consisting of physics, chemistry, life science and Earth science. 10 <sup>th</sup> to 12 <sup>th</sup> grade students can select 20 credits from integrated science, physics I and II, chemistry I and II, life science I and II, and Earth science I and II. If a student wants to major in Earth science, he takes courses from integrated science→ Earth science I→ physics I→ Earth science II. If a student just wants to study general science, he chooses: integrated science→ physics I→ biology I→ chemistry I etc.
<b>Malawi</b>	Yes	There is a compulsory curriculum at Primary and Secondary levels (Geography) and University levels for those taking Earth Science as an option.
<b>New Zealand</b>	Yes (years 1-13) i.e. aged 6 to 18 years at High School then Univ.	Students can only study Earth science (mostly geology) at senior high school level age 16/17/18, by doing science which is one of four strands, or by doing biology for evolution. Examination is by external and internal standard-based assessment (criterion referenced). The revised curriculum of 2007 is now in the implementation phase. The Planet Earth and Beyond strand inquires about Earth systems, interacting systems and astronomical systems across all levels of schooling. Geology <i>per se</i> is now minimal. Examinations, which begin at age 15 (Year 11), are external and internal and still criterion referenced. Evolution teaching now occurs across all levels within the Living World strand.
<b>Norway</b>	Yes	Competence goals by the end of Grades 2, 4, 7, and 10.
<b>Philippines</b>	Yes	Starting in June 2012, kindergarten has become compulsory in Philippine schools. In Elementary education, science in grades 1 and 2 are taught in a language class. Formal science subjects start in grade 3. The school year 2012-13 implements the K plus 12 curriculum. Prior to this, elementary education was 6 years and high school education was just 4 years after which the students could get into University. With the new structure, there is an additional two years added to the pre-University education of Filipino students. Earth science topics will now be taught in grades 7 to 10 for high school. Unlike before, when it was limited to just grade 7 (then called "First Year High School"). This is great news for Earth science education in the Philippines.
<b>Portugal</b>	Yes	
<b>Romania</b>	Yes	
<b>Russia</b>	Yes	State educational standards for general education
<b>Saudi Arabia</b>	Yes	
<b>Scotland</b>	No	Guidelines against which inspection regime operates, but not 'technically' compulsory. Then choices of examination courses, including geography, which includes Earth science material, and science, which does not.
<b>South Africa</b>	Yes	Geosciences are included in small areas (e.g. dinosaurs) in the Foundation Phase of our National Curriculum (Grades 1-3). Also, as a strand called "Planet Earth and Beyond" in a subject called Natural Sciences (a combined science subject) which operates from Grade 4 to 9. After grade 9 learners cover Geosciences in various subjects, but mainly Geography (plate tectonics etc.) and Life Sciences (Evolution and the Fossil Record).



Country	National Standard (school level)	Comment
<b>Sri Lanka</b>	Yes	The national curriculum is compulsory for government-maintained schools which are the vast majority of schools. Few concepts related to Earth science are incorporated into school education at primary level (from grade 6) and science and geography students of senior high school level. Examinations of Grade 11 and 13 are held at national level.
<b>Spain</b>	Yes	However, all of the 17 Autonomous Communities can introduce up to 40% changes in the curriculum to adapt it to the conditions of each area.
<b>Taiwan</b>	Yes	There are specific Earth science standards for 9 <sup>th</sup> grade and 10 <sup>th</sup> grade respectively. The standards are the national-mandatory guidelines for developing the school curriculum. All the school systems comply with the standards.
<b>Trinidad &amp; Tobago</b>	Yes	At the secondary level, Earth science is part of geography and to a lesser extent, the environmental studies and social studies syllabi. Although there is a National Curriculum for these subjects, they are not compulsory across the country.
<b>Uruguay</b>		
<b>United States</b>	Yes	There is no National Curriculum in the USA. There are National Standards (the National Science Education Standards (NSES), created and published by the US National Research Council) that act as strongly recommended models for the development of State standards; most State standards do closely reflect the National Standards. In many states, the curriculum and standards are actually determined at the level of school districts (clusters of schools around individual cities and towns), though these should in principle be in close alignment with State standards. A few states such as New York have statewide year-end exams at the secondary school level and thus have a statewide curriculum in specific topics (earth science, biology, chemistry, etc.), but most states do not. The United States has recently embarked on an effort to revise the NSES and has recently published (July 2011) a conceptual Framework for Science Education to guide reform efforts.

#### Summary of the 'National Standards' data

Countries with National Standards in Earth Science - 26		
Argentina	Italy	Saudi Arabia
Brazil	Japan	South Africa
Canada	Korea	Sri Lanka
Czech Republic	New Zealand	Spain
England	Norway	Taiwan
Estonia	Philippines	Trinidad & Tobago
Finland	Portugal	United States
Indonesia	Romania	
Israel	Russia	

Countries with no National Standards in Earth Science - 5
Bangladesh
France
Germany
India
Scotland

**Does earth science form part of the compulsory curriculum?**

- Does earth science form part of the compulsory curriculum for

5 – 7 year olds?	7 - 11 year olds?	11 - 14 year olds?	14 - 16 year olds?	16 - 18 year olds?
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Country	5 – 7 year olds?	7 - 11 year olds?	11 - 14 year olds?	14 - 16 year olds?	16 - 18 year olds?
<b>Argentina</b>	Yes	Yes	Yes	Yes	Yes
<b>Australia</b>	Yes	Yes	Yes	Yes	No
<b>Bangladesh</b>	There is no science subject for age group 5-7 but in some kindergarten schools some insignificant aspect of science are being taught.	The fundamentals of geosciences are in the national curricula of school students of age groups 8-10 belonging to classes III, IV and V. Some aspects of geosciences or Earth science like bio-world, atmosphere, land-water-air, weather, climate, forest and environment, Earth and universe, Earth's crust, rocks, seas, ocean, power, energy, natural resources, natural disasters, surface of the Earth etc. are included in the syllabuses of general science for students of age groups 8 -11 and 11-14. But there is no separate subject of Earth science or geoscience.	In the syllabuses of national curricula of classes from VI to VIII of student age from 11 to 13, some more topics of geosciences are included in General Science.  Students of age groups 14-16 and 16-18 belong to classes IX – X and XI – XII, that is students of secondary and higher secondary levels of education. In both levels there are three groups – humanities, commerce and science.  For the science group, physics, chemistry, maths or biology are compulsory subjects and geography is an optional subject for all groups. Disaster management and population problems are taught as part of social science.	In science group of both classes IX and X, physics, chemistry, biology, maths and social science are common separate subjects but there is no geoscience subject.  In the commerce group of both classes of IX and X, some topics of geoscience are included in the syllabuses of general science.  Student of age group of 14-16 and 16-18 belong to classes IX – X and XI – XII, that is students of secondary and higher secondary levels of education. In both levels there are three groups – humanities, commerce and science.  For the science group physics, chemistry, math or biology are compulsory subjects and geography is	

Country	5 – 7 year olds?	7 - 11 year olds?	11 - 14 year olds?	14 - 16 year olds?	16 - 18 year olds?
			For the commerce group, the world of science, population and environment, house building materials, energy, fuel, minerals, ecology, disaster management, commercial geography, plants and animals are taught as part of general science.	an optional subject for all groups. Disaster management and population problems are taught as part of social science.  For the commerce group, the world of science, population and environment, house building materials, energy, fuel, minerals, ecology, disaster management, commercial geography, plants and animals are taught as part of general science.	
Only geography is taught as separate subject in all groups but not as a compulsory subject					
<b>Belgium</b> : French part = Communauté française de Belgique = Wallonia and Bruxelles	No	Earth sciences are part of the compulsory curriculum for students older than 10 years.			
<b>Brazil</b>	No	Only the geography and sciences disciplines are taught as separate subjects in all groups but Earth sciences are not a compulsory subject			
<b>Canada</b>	Some	Yes	Yes	Some	Few
<b>Czech Republic</b>	Partly yes	Earth sciences are compulsory for ages 7 – 18. There is no science curriculum, but curricula for physics, chemistry, biology etc. The main part of the Earth science curriculum (minerals, rocks,) is taught in geography and biology for ages 11-14.			
<b>England</b>	Yes	Yes	Yes	Yes	No
<b>Estonia</b>	No	Yes	Yes	Yes	Yes
<b>Finland</b>	Yes	Yes	Yes	Yes	Yes
<b>France</b>	No	Yes	Yes	Yes	Yes
<b>Germany</b>	No	Yes	Yes	Yes	Yes/ No it depends on the Federal State

Country	5 – 7 year olds?	7 - 11 year olds?	11 - 14 year olds?	14 - 16 year olds?	16 - 18 year olds?
India	Yes	Yes	Yes	Yes	No
Indonesia	No	Yes As a part of geography	Yes As a part of geography	Yes In the field of natural science, as a part of physical geography	
Israel	Yes	Yes	Yes	Yes	Yes
Italy	No, not compulsory but allowed	Not compulsory but allowed	Yes	Yes	Yes (just in some types of school, called Lyceum)
Japan	Yes	Yes	Yes	Yes	Yes
Korea	Yes	Yes	Yes	Yes	Yes
Malawi	No	No	No	No	No (only geography is taught at all these levels but is not compulsory).
New Zealand	Yes	Yes	Yes	Yes	As part of science or biology.
Norway	No	Yes	Yes	Yes	Optional
	Earth science topics are taught in general science and geography. Optional Earth science specialisation in Grade 12 and 13 (17-19 year olds)				
Philippines	Yes	Yes	Yes	Yes	It depends on the thrust of the school
	<p>The year 2012 is a milestone in the history of Philippine education, let alone Earth science education. Kindergarten has become compulsory in Philippine schools by legislation. It used to be for the elite and offered only by private schools. The new K+12 curriculum added two more years in high school. Whereas before our students graduated in secondary school at the age of 16, now they will graduate at the age of 18. Earth science in the previous curriculum spiralled from grades 3 to 6 and then became part of "Integrated Science" in First Year High School (grade 7). After this, there was no more Earth science in high school. However, in the new K+12 curriculum, Earth science spirals from kindergarten right up to grade 10. Note, however, that Science is not taught formally in kindergarten until grade 2 but is learned in the Language subjects. The new K + 12 curriculum clearly specifies the Earth science topics to be taught from grades 3 to 10. In grades 11 and 12, students are mainstreamed as they prepare for vocational or university education.</p>				
Portugal	Yes	Yes	Yes	Yes	No
Romania	Yes	Yes	Yes	Yes	Yes
Russia	Yes	Yes	Yes	Yes	
	In Russia professional development among the teachers is organized by regional divisions of education				
Saudi Arabia	No	No	No	No	Yes
Scotland	Yes	Yes	Yes	No	No
South Africa	Yes	Yes	Yes	Yes	No
Spain		Yes	Yes	Yes	No

Country	5 – 7 year olds?	7 - 11 year olds?	11 - 14 year olds?	14 - 16 year olds?	16 - 18 year olds?
Sri Lanka	No	No	Yes	Yes	Yes (for geography and chemistry)
Taiwan		Yes	Yes	Yes	
Trinidad & Tobago	No	Yes	No	No	No
Uruguay	Yes	Yes	Yes	Yes	Yes
United States	Yes In many states it is included in standards	Yes In many states it is included in standards	Yes In many states it is included in standards	No	No

**Summary of the 'compulsory curriculum' data**

Country	5 – 7 year olds?	7 - 11 year olds?	11 - 14 year olds?	14 - 16 year olds?	16 - 18 year olds?
Totals/34	18 = 53%	29 = 85%	30 = 88%	26 = 76%	13 = 38%

**THE APPROACH TO EARTH SCIENCE TEACHING CAN BE SUMMARISED AS:**

- A small compulsory part of a national science curriculum, e.g.
  - part of 'natural sciences' and generally taught by biology specialists;
  - generally taught by chemistry specialists;
  - normally taught by general science teachers.
- A small compulsory part of a national geography curriculum
- Additional optional geoscience courses

Country	Compulsory part of the national science curriculum as part of 'natural sciences' and generally taught by biology specialists	Compulsory part of the national science curriculum – generally taught by chemistry specialists	Compulsory part of the national science curriculum – generally taught by general science teachers	Compulsory part of the national science curriculum – generally taught by earth science specialists	Compulsory part of the national geography curriculum	Not part of the compulsory curriculum	Offered as optional geoscience courses a year or more long	Other (please specify)
Argentina	Yes							
Australia								
Bangladesh			Yes	X	Normally taught by geography teachers and also by teachers of other disciplines			In secondary and higher secondary education physics, maths, chemistry, biology, etc are generally taught by teachers of the respective subjects
Belgium					Yes			

Country	Compulsory part of the national science curriculum as part of 'natural sciences' and generally taught by biology specialists	Compulsory part of the national science curriculum – generally taught by chemistry specialists	Compulsory part of the national science curriculum – generally taught by general science teachers	Compulsory part of the national science curriculum – generally taught by earth science specialists	Compulsory part of the national geography curriculum	Not part of the compulsory curriculum	Offered as optional geoscience courses a year or more long	Other (please specify)
Brazil	Yes		Yes		Yes			In the middle level of basic education physics, maths, chemistry, biology, etc are generally taught by teachers of the respective subjects
Canada	Few		Yes		Some		Some	Yes (SK individual School District courses)
Czech Republic	Yes and ...			Yes				
England		Yes			Yes		Course for 14-16 year olds (GCSE) Course for 16-18 year olds (A-level)	
Estonia								
Finland					Yes			
France	Yes							
Germany					Yes			

Country	Compulsory part of the national science curriculum as part of 'natural sciences' and generally taught by biology specialists	Compulsory part of the national science curriculum – generally taught by chemistry specialists	Compulsory part of the national science curriculum – generally taught by general science teachers	Compulsory part of the national science curriculum – generally taught by earth science specialists	Compulsory part of the national geography curriculum	Not part of the compulsory curriculum	Offered as optional geoscience courses a year or more long	Other (please specify)
India			Yes					
Indonesia					Yes			
Israel			Yes K-9 Elementary and Junior High school				In the high school a 5 credit point 3-year programme – taught only by Earth science specialists.	
Italy	Yes							
Japan				Yes				
Korea				Yes				
Malawi						Yes, its optional		
New Zealand	Probably		Yes		Yes			The new curriculum has encouraged a greater variety of courses, often minimising geoscience



Country	Compulsory part of the national science curriculum as part of 'natural sciences' and generally taught by biology specialists	Compulsory part of the national science curriculum – generally taught by chemistry specialists	Compulsory part of the national science curriculum – generally taught by general science teachers	Compulsory part of the national science curriculum – generally taught by earth science specialists	Compulsory part of the national geography curriculum	Not part of the compulsory curriculum	Offered as optional geoscience courses a year or more long	Other (please specify)
Norway			Yes (Grade 1-11)		Yes (Grade 8-11)		Yes (Grade 12 and 13)	
Philippines			Yes					
Portugal	Yes							
Romania								
Russia			Yes		Yes			Plus in physics
Saudi Arabia								
Scotland								Part of the primary curriculum – taught by primary teachers
South Africa	In the Natural Sciences 'Planet Earth and Beyond' is taught by a mixed bag of teachers- biology, chemistry, physics - few Earth scientists and sometimes even by non-science specialists so the quality of teaching is very variable.							
Sri Lanka		Yes			Yes			
Spain	Yes							
Taiwan				Yes				
Trinidad & Tobago								
Uruguay								

Country	Compulsory part of the national science curriculum as part of 'natural sciences' and generally taught by biology specialists	Compulsory part of the national science curriculum – generally taught by chemistry specialists	Compulsory part of the national science curriculum – generally taught by general science teachers	Compulsory part of the national science curriculum – generally taught by earth science specialists	Compulsory part of the national geography curriculum	Not part of the compulsory curriculum	Offered as optional geoscience courses a year or more long	Other (please specify)
United States							Offered in some school districts, either at 11 -14 or as a capstone for older students.	It depends on the state whether or not Earth science is compulsory. It may be taught either by generalists, specialists in other areas, or Earth science specialists.

**Summary of the 'Approach to Earth science teaching' data**

Earth science teaching approach	Countries
Compulsory – part of Natural Sciences – taught mostly by biology teachers	Argentina, Brazil, Czech Republic, France, Italy, Portugal, Spain
Compulsory – part of chemistry and geography – taught mostly by these teachers	England, Sri Lanka
Compulsory – part of general science and geography – taught mostly by these teachers	Bangladesh, India, New Zealand, Norway, Russia
Compulsory – part of general science – taught mostly by these teachers	Canada, Israel, Philippines, South Africa
Compulsory – part of science – taught mostly by Earth science teachers	Japan, South Korea, Taiwan
Compulsory – part of geography – taught mostly by geography teachers	Belgium, Germany, Finland, Indonesia
Compulsory – part of primary science and geography – taught mostly by primary teachers	Scotland
Not compulsory	Malawi

### APPROPRIATE TEACHING MATERIALS

- Are appropriate teaching materials (such as textbooks, worksheets, practical activities) available in the country to support earth science teaching?
- At what age levels are the materials available? Give examples and comment, where possible

Country	5 – 7 years	7 – 11 years	11 – 14 years	14 – 16 years	16-18 years	
<b>Argentina</b>	The availability of good teaching materials is scarce and sometimes written by non-geologists, lacking local examples and sometimes carrying important mistakes.					
<b>Australia</b>	No	Some curriculum materials are produced by the Mining Industry Organisation, Geoscienc Australia and local Geological Surveys			No – the Australian Academy of Science produced a text which is widely used but is no longer in print.	
<b>Belgium</b>	There are textbooks covering the related subjects; among them, some Earth science topics are included, but teachers produce their own worksheets and activities. Training programmes for in-service teachers of basic education focusing on the Earth Sciences are still lacking.					
<b>Brazil</b>			Carneiro C.D.R. (Editor cient.). 2000. <i>Geologia</i> . São Paulo: Global/SBPC. 80p. (Série Ciência Hoje na Escola, v. 10).			
<b>Canada</b>	Yes (NT,SK,BC,YK,NB)	Yes All Mostly textbooks For all Age Levels: Teaching materials developed or compiled by the geoscience outreach community include EdGEO - practical activities ( <a href="http://www.edgeo.org">www.edgeo.org</a> ) Geoscape Canada - posters (14 across Canada), Geotour guides (9 in BC and Ontario), GeoMaps (5) ( <a href="http://www.nrcan.gc.ca/earth-sciences/products-services/mapping-product/geoscape/6032">www.nrcan.gc.ca/earth-sciences/products-services/mapping-product/geoscape/6032</a> ) Earthlinks <a href="http://www.earthsciencescanada.com/earthlinks">www.earthsciencescanada.com/earthlinks</a> links to selected excellent Canadian online resources for teachers		Yes All Teaching materials with local content are being developed in some jurisdictions	Yes (ON,NT,SK,BC,YK)	Yes All except AB ON (textbooks from USA - lack Canadian content) NL (textbooks/ workbooks) NT (developed Experiential Science 10, 20, 30 Textbooks with accompanying Teachers Resource Manuals) SK (textbooks – SK relevant ES materials are being developed) BC/YK (textbooks mostly from USA textbooks - lack Canadian or BC/YK content) NB (textbooks – some are outdated, Big Ideas in Earth Science
<b>Czech Republic</b>	There are textbooks for the subjects, where the topics are included. Worksheets and activities have to be prepared by teachers themselves.					
<b>England</b>	No	ESTA's 'Working with ...'	ESTA's 'Science of the	ESTA's 'Investigating the	Geoscience - textbook for	

Country	5 – 7 years	7 – 11 years	11 – 14 years	14 – 16 years	16-18 years
		packs	<p><i>Earth'</i> units Joint Earth Science Education Initiative (JESEI) website.</p> <p>All general science and geography textbooks have an Earth science component.</p>	<p><i>Science of the Earth'</i> units Joint Earth Science Education Initiative (JESEI) website.</p> <p>All general science and geography textbooks have an Earth science component.</p> <p>GCSE geology book, '<i>Basic Books in Science Book 6: The planet we live on – the beginnings of the earth sciences</i>', online book at: <a href="http://www.learndev.org">http://www.learndev.org</a></p>	the A-level curriculum published in 1999 OCR Geology – textbook published for the OCR geology A-level in 2008.
<b>Estonia</b>	No	Yes, textbooks, worksheets, practical activities			

Country	5 – 7 years	7 – 11 years	11 – 14 years	14 – 16 years	16-18 years
<b>Finland</b>	<p>Yes</p> <p>Several series of books with extra materials. The substance is based on following: In pre-school curricula, topics for Natural Science can be for example be from the following areas: Man and his/hers relations to the environment, Earth and Space, substances and materials of nature and energy. Topics are introduced in relation to a child's own environment and everyday life. Themes are planned so that they offer a child an opportunity to widen and develop their world view and understanding of the natural surroundings.</p>	<p>Yes</p> <p>Several series of books with extra materials. The substance is based on following (from the National Curricula): Grades 1-4: Geography, biology, physics and chemistry are taught together In geography, pupils own neighbourhood is studied, including the landscape, maps and planetary phenomena; In addition Finland and the Nordic countries are covered by the national curriculum</p>	<p>Yes</p> <p>Several series of books with extra materials. The substance is based on following (from the National Curricula): Grades 5-6, usually class teachers: Biology and geography are together Europe, including Russia, is in the curriculum There are differences between text books (different publishers) In Finland the text books are important for guiding teachers</p>	<p>Yes</p> <p>Several series of books with extra materials. The substance is based on following (from the National Curricula): Grades 7-9, geography teachers:</p> <ul style="list-style-type: none"> <li>• Different continents of the world, at least two continents (according to the text book)</li> <li>• Europe in global context</li> <li>• Finland in global context</li> <li>• Environmental issues</li> </ul>	<p>Yes</p> <p>Several series of books with extra materials. The substance is based on following (from the National Curricula): Upper secondary school, usually 3 yrs, 4 geography courses</p> <ul style="list-style-type: none"> <li>• Physical geography</li> <li>• Human geography = 2 obligatory courses</li> <li>• Regional studies and GIS</li> <li>• Geography of risks and possibilities (global threats)</li> <li>• Matricular examination, where geography is optional.</li> </ul> <p>Recently University Geology entrance exams have been based on these materials (increasing the number of applicants 4-5 times, in Helsinki from 100 to 500, while intake is 26). The latest books series was made in cooperation with geology teachers.</p>
<b>France</b>			Posters – models – school book	Models – cookbook – softs	Models – cookbook – softs
<b>Germany</b>		Project System Earth book and CD-ROM			Project System Earth CD-ROM (11 Modules)
<b>India</b>	A range of materials, including textbooks, guides and other materials is generally available.				

Country	5 – 7 years	7 – 11 years	11 – 14 years	14 – 16 years	16-18 years
<b>Indonesia</b>	No	No	Geography textbooks for elementary and junior high school - Earth science is only a part of the content of these books. Different textbooks can be used, but the textbooks must follow the national curricula established by the Ministry of Education. Multimedia educational material is still limited.	A geography textbook for senior high school – Earth science is only a part of the content of the book. Different textbooks can be used, but the textbooks must follow the national curricula established by the Ministry of Education. Multimedia educational material is still limited.	
<b>Israel</b>	<i>Let's Rock; Sensing environment</i>	Earth systems-based units including lab, outdoor and computer activities. For example: <i>Window for the environment; Beneath our feet; The water cycle; Rocks, matter and materials; Measuring the environment; Understanding the environment.</i>	Earth systems-based units including lab, outdoor and computer activities. For example: <i>The rock cycle; The blue planet; Cycles in the atmosphere; Continents drift and theories clash; From Earth to the moon and back; The environment's nature.</i>	Earth systems-based units including lab, outdoor and computer activities. For example: <i>The geosphere and the Earth systems; The Earth's structure and plate tectonic theory; The atmosphere and the Earth systems; The oceans and the Earth systems; From the dinosaurs to Darwin: evolution in the perspective of time. Earthquakes in an environmental perspective.</i>	
<b>Italy</b>	Textbooks, CD-ROMs, videotapes, DVDs... Provided by school book editors, museums, universities, INGV – National Institute of Geophysics and Vulcanology, ANISN- National Natural Science Teachers Association, Earth Learning Idea <a href="http://www.earthlearningidea.com/">http://www.earthlearningidea.com/</a>			Textbooks, CD-ROMs, videotapes, DVDs... Provided by school book editors, museums, universities, INGV – National Institute of Geophysics and Vulcanology, ANISN- National Natural Science Teachers Association, Earth Learning Idea <a href="http://www.earthlearningidea.com/">http://www.earthlearningidea.com/</a> ; I-Cleen <a href="http://www.icleen.museum/">http://www.icleen.museum/</a>	

Country	5 – 7 years	7 – 11 years	11 – 14 years	14 – 16 years	16-18 years
<b>Japan</b>	Textbooks authorised by the Ministry of Education, Culture, Sports and Technology (MEXT) and distributed free of charge. Other supplementary teaching materials are provided by several publishers.			Up to the age of 15 (9 <sup>th</sup> grade), textbooks are authorised by the Ministry of Education, Culture, Sports and Technology (MEXT) and distributed free of charge. Other supplementary teaching materials are provided by several publishers. For 16 year olds (10 <sup>th</sup> grade), textbooks authorised by the Ministry of Education, Culture, Sports and Technology (MEXT) are distributed <b>not</b> free of charge. Other supplementary teaching materials are provided by several publishers.	Textbooks authorised by the Ministry of Education, Culture, Sports and Technology (MEXT) are distributed <b>not</b> free of charge. Other supplementary teaching materials are provided by several publishers.
	<p>The system of textbook authorisation for elementary, lower and upper secondary schools is implemented in order to guarantee the citizen's right to receive an education, to maintain and improve the national standard of education and to secure neutrality in education. This system attempts to encourage private textbook publishers to be creative and innovative when writing and compiling textbooks. The authorisation system also ensures the publication of textbooks with appropriate content.</p> <p>The Rika-e Initiative is a program to enhance science and technology education by using digitalised study materials that are developed with the latest technology such as science simulation programs. The content will cover various topics related to science and technology, and are classified on the basis of the 'National Curriculum Standard', as represented by the Courses of Study, in order to make it easier for teachers to use them in daily lessons. The study materials will be distributed to every classroom in Japan through the Internet for example NICER (National Information Center for Educational Resources), by the end of 2005.</p>				
<b>Korea</b>	Textbooks are published by the national agency and other supplementary teaching materials are produced by several publishers. Textbooks are published and inspected and authorised by government		Textbooks and other teaching materials are published by several textbook publishers. 16 publishers are usually adopted by the public. Each publisher provides internet services and other	Textbooks and other teaching materials are published by several publishers. Fewer publishers have developed the textbooks used in high schools. The publishers have recruited some	Textbooks and other teaching materials are published by several publishers. Professors at universities select textbooks by themselves, they can be written by foreign scholars

Country	5 – 7 years	7 – 11 years	11 – 14 years	14 – 16 years	16-18 years
			supplementary resources. The final authorisation and adaptation is run by government through reviewer team organised by government consisting of professors, researchers and other administrators.	professors, researchers and teachers in Earth science field to develop one textbook to be adopted by schools. The adoption process takes another 2 or 3 months by the team organised by government. Publishers can develop textbooks which must be authorised by the government.	from aboard or by domestic scholars in Korea. Those textbooks don't have to undertake the process of adaption to be the main textbooks at universities. Publishers just produce books written by authors whose major is Earth science and professors choose them as textbooks.
<b>Malawi</b>	Texts are available (geography) at all levels but are out-dated.				
<b>New Zealand</b>		Mixed with general science texts but they often ignore geoscience.	Relph, Vallender, Walker and Dunlop. Now out of sync with curriculum.	Relph, Vallender, Walker and Dunlop. Now out of sync with curriculum.	An area of concern as minimal new materials have been developed for the 2007 curriculum.
<b>Norway</b>	Several textbooks in geography and general science are available – the schools choose textbook themselves. The Norwegian Centre for Science Education offers web-based interactive programs about plate tectonics, oil and the geological history of Norway, and also recommended activities on the web site <a href="http://www.naturfag.no">www.naturfag.no</a> (including links to Norwegian versions of Earthlearningidea).				
<b>Philippines</b>	We have textbooks and workbooks from kindergarten to grade 7. Because of the new K+12 curriculum, new resource materials need to be developed. Some publishers now are getting into digital resources (non-print) utilising iPads and tablets for interactive lessons.				
<b>Portugal</b>	Textbooks	Textbooks	Textbooks and worksheets	Textbooks and worksheets	Textbooks
<b>Romania</b>		Yes	Yes	Yes	Yes
<b>Russia</b>	Yes	Text book in nature	Text book in geography	Text book in geography	Text book in geography
<b>Saudi Arabia</b>					Yes, textbook
<b>Scotland</b>	Yes				



Country	5 – 7 years	7 – 11 years	11 – 14 years	14 – 16 years	16-18 years
<b>South Africa</b>	Mix of government-produced workbooks, commercially produced books and teachers' own notes.	Mix of teacher-produced notes and commercial textbooks. Of variable quality.		Mainly commercial textbooks covering the syllabus. Of variable quality	
<b>Sri Lanka</b>	No	No	No Some basic concepts of Earth science are included in text books provided by the government.	No Some basic concepts of Earth science are included in text books provided by the government. Some schools use Earth materials and models for practical classes.	No Some schools use models, Earth materials, text books, maps and field equipment, specially for geography students.
<b>Spain</b>	No	Textbooks, CD-ROMs, videotapes, DVDs ... Most of these are in Spanish. Some are in English. Also in Catalan, Basc and Galician.	Textbooks, CD-ROMs, videotapes, DVDs ... Most of these are in Spanish. Some are in English. Also in Catalan, Basc and Galician. Electronic Interactive Books.	Textbooks, CD-ROMs, videotapes, DVDs ... Most of these are in Spanish. Some are in English. Also in Catalan, Basc and Galician. Electronic Interactive Books.	Textbooks, CD-ROMs, videotapes, DVDs ... Most of these are in Spanish. Some are in English. Also in Catalan, Basc and Galician.
<b>Taiwan</b>	The rocks, water, and air - knowing the things in the natural world	The components of the air - knowing the things we cannot see	Water cycle and seasons - knowing the important components of life	Plate tectonics - knowing things that shape the Earth	
<b>Trinidad &amp; Tobago</b>	Textbooks, worksheets				
<b>Uruguay</b>			Geografía 1º Editorial Monteverde Geografía I Editorial Santillana	Geografía 3º Uruguay en la integración Editorial Monteverde Geografía III Uruguay en y la region Editorial Santillana	
<b>United States</b>	FOSS (Full Option Science System)	ESIP (Earth Systems Program Implementation Project) Project	<i>Investigating Earth Systems</i> (IES) curriculum Project CUES	<i>EarthComm</i> curriculum <a href="http://edmall.gsfc.nasa.gov/acps/curriculum.html">http://edmall.gsfc.nasa.gov/acps/curriculum.html</a>	Advanced Placement Environmental Science
	Various materials, including textbooks, curriculum guides and other materials are generally available. The quality of these materials ranges from poor to excellent. Among the more general challenges, is that many of the materials are not based on the latest education research and are not fully inquiry-based.				

**Summary of the 'textbook availability' data**

<b>Country</b>	<b>5 – 7 years</b>	<b>7 – 11 years</b>	<b>11 – 14 years</b>	<b>14 – 16 years</b>	<b>16-18 years</b>
<b>Good quality total/33</b>	<b>15 = 45%</b>	<b>17 = 52%</b>	<b>22 = 67%</b>	<b>20 = 61%</b>	<b>21 = 64%</b>

## BENCHMARKING

If your country/region has a National Curriculum or National Standards that are compulsory across the country/region, please indicate which terms appear and at what levels and in which area of the curriculum.

### Summary of benchmarking data (*the full data, country by country, is available on request*)

Country	Term is present	5 – 7 year olds	7 – 11 year olds	11 – 14 year olds	14 – 16 year olds	16 – 18 year olds
<b>Argentina</b>						
<b>Australia</b>						
<b>Bangladesh</b>	11	0	0	11	0	0
	For pupils of age range from 8-11, fundamental geoscience terms are included in general curricula. For pupils of age range 11-14, more detailed terms are included in general science syllabuses (mentioned previously in this report). For pupils of ages 14-16, some terms are included in general science taught to the Commerce group. For the Science group - physics, chemistry, maths, biology and social science are common separate subjects for students of age group 14-16 and 16-18. Geography is a common subject for both age groups, 14-16 and 16-18, but is not compulsory.					
<b>Belgium</b>	108	15	44	30	56	105
<b>Brazil</b>	72	0	0	61	15	0
<b>Canada</b> (Note: Totals are compounded totals derived from separate reporting by 8 out of 13 educational jurisdictions)	124	40	108	121	124	124
<b>Czech Republic</b>	National curricula are divided into subjects: physics, chemistry, biology, geography... For students aged 16-18 there are seminars, but seminars are not included in curricula, topics of teaching depend on teachers					
<b>England</b>	28	6	18	15	4	0
<b>Estonia</b>	120	0	47	80	116	120
<b>Finland</b>	Pre-school, 7-10 yr olds, 11-12 yr olds, 13-15 yr olds, 16-18 yr olds					
	40	17	23	16	17	31
<b>France</b>	124	1	7	71	111	124
<b>Germany (Lower Saxony)</b>	42	0	2	27	7	12
<b>India</b>	Up to age 16 the entire Indian curriculum is technically a general curriculum as these terms occur in science as well as social studies. Distinctions into science and social studies are clear, but teachers mix them.					
<b>Indonesia</b>	112	5	10	65	93	112
<b>Israel</b>	112	18	62	92	94	112

Country	Term is present	5 – 7 year olds	7 – 11 year olds	11 – 14 year olds	14 – 16 year olds	16 – 18 year olds
India						
Italy	55	15	5	23	14	28
	Note: despite the fact that many terms do not appear written in the curriculum most of them appear in school text books and are taught, especially to 14-16 and 16-18 year olds. In Italy we have three main type of upper secondary school – in only one of these is Earth science is taught at the 16-18 year old level.					
Japan						
Korea	123	20	79	113	121	123
Malawi	85	8	35	47	53	85
New Zealand	91	7	25	74	43	37
Norway	48	1	10	12	24	43 - optional
	COMMENT: looking for specific terms is not very applicable to the Norwegian curriculum. The competence goals in the national curriculum are wide open because they should allow teachers some local freedom. For instance, a competence goal in science Grade 8-10 is: <i>write logs during practical work and fieldwork and present reports with digital tools</i> . As a teacher, you are free to teach Earth science topics through such broad competence aims. Another example of competence aims from the geoscience curriculum (Grade 12) is: <i>explain the formation of magmatic and metamorphic rocks by using the theory of plate tectonics</i> . This does not specify which geoscientific terms or rock names they should learn. In other words, our curriculum does not dictate 'relevant' terms to teachers in particular instructional contexts. However, the textbooks contain numerous geoscientific terms, but that is not legally binding in the same way as the national curriculum.					
Portugal	105	20	54	73	87	85
Romania	104	3	18	73	91	104
Russia	128	6	33 - 35	60	26	0
Scotland	31	0	1	14	0	0
South Africa	96	2	3	49	76	107
	Note that in South Africa, ages and subject categories are slightly different.					
Saudi Arabia	118	1	9	11	11	86
Scotland	Up to age 14 the entire Scottish curriculum is technically a general curriculum. Distinctions into science and geography are evident in the curricular documents, but primary teachers are expected to mix these and discrete subject teaching does not occur. Secondary teachers (12-14 yr olds) normally teach in discrete subjects.					
Sri Lanka	102	5	15	43	91	102
Spain	124	41	85	103	116	124
Taiwan	96	15	40	83	107	97
Trinidad & Tobago	76	19	25	46	36	48
United States						
Uruguay	108	0	66	94	103	103

**Summary of the 'benchmarking' data**

<b>Country</b>	<b>Term is present</b>	<b>5 – 7 year olds</b>	<b>7 – 11 year olds</b>	<b>11 – 14 year olds</b>	<b>14 – 16 year olds</b>	<b>16 – 18 year olds</b>
<b>Mean/27</b>	<b>88 = 71%</b>	<b>10 = 8%</b>	<b>31 = 25%</b>	<b>56 = 45%</b>	<b>61 = 49%</b>	<b>72 = 58%</b>

## EDUCATIONAL SYSTEM BACKGROUND

Comment on the educational system background

- How many years of education are compulsory or what level of education is compulsory?
- Are there local, regional or national tests, which provide baseline information on student learning in the earth sciences or geosciences
- Are these tests compulsory?
- How are the resulting test data used?

Country	How many years of education are compulsory or what level of education is compulsory?	Are there local, regional or national tests, which provide baseline information on student learning in the earth sciences or geosciences	Are these tests compulsory?	How are the resulting test data used?
<b>Argentina</b>	Compulsory from 6 to 17 years old	No		
<b>Australia</b>	Schooling is compulsory for students in most states and territories until the age of fifteen. Although students are able to leave at that time, most students do not leave until they complete their Year 10 qualification, with many students continuing on to complete their Year 12 studies.	No		
<b>Bangladesh</b>	There is no provision for compulsory education. Study in classes from I to V of ages 6 -10 are free for all boys and girls. Girl students can study classes from VI to XII (age range 11 – 18) free of charge but with some conditions like, 'her attendance in the classes must be 75% and she must obtain 40-45% marks in the exam'.	As there is no separate geoscience or Earth science curriculum in school and college level education, there is no test that provides baseline information on student learning in the geosciences. And there is also no initiative for such approaches either.		

Country	How many years of education are compulsory or what level of education is compulsory?	Are there local, regional or national tests, which provide baseline information on student learning in the earth sciences or geosciences	Are these tests compulsory?	How are the resulting test data used?
<b>Belgium</b>	Up to 18 years old	No	No	No
<b>Brazil</b>	13 years 6-18 year old	No		
<b>Canada</b>	To Grade 12 (ON, BC, YK, NB, AB) Compulsory to age 16 NF To Grade 10 NT To Grade 10 for work, although most companies require Grade 12 SK	No national test Public exam for high school course Earth Systems 3209 NL Alberta Provincial Achievement in Math and Science Grades 3,6,9 and 12 AB/NT Proposed standard testing for grades 4-12 by 2016 SK Provincial test Grade 10 BC Provincial test Geology 12 YK	Provincial assessments and public exams are compulsory NL, AB, BC, YK	To assess student achievement for certification and graduation, university entrance. To assist with school growth and development NL Plan to have formative assessment to direct learning AB For comparison with other schools, provinces, to improve teaching practices, focus on student weaknesses, skills, curriculum SK
<b>Czech Republic</b>	9 years	No		
<b>England</b>	11 years	No There are science SATS tests for 11 year olds and GCSE examinations in science and geography for 16 year olds, but none of these produce information specific to geoscience.	SATS are compulsory. GCSE subjects are optional apart from English, Maths and science.	Cannot be used for geoscience comparisons
<b>Estonia</b>	17years old, must complete basic education	No	No	No
<b>Finland</b>	9 yrs	Yes, matricular exam	No	Top marks gives extra points while applying to the universities

<b>Country</b>	<b>How many years of education are compulsory or what level of education is compulsory?</b>	<b>Are there local, regional or national tests, which provide baseline information on student learning in the earth sciences or geosciences</b>	<b>Are these tests compulsory?</b>	<b>How are the resulting test data used?</b>
<b>France</b>	16 years	Baccalaureate in science for 18 year olds.		
<b>Germany</b>	9	No	No	No
<b>India</b>	Up to class X (15-16 yrs)	No	No	No
<b>Indonesia</b>	9 years Elementary School and Junior High School	Yes-geography, also maths, physics, biology, social science, Indonesian language, Pancasila (National Philosophy), and religion – these national tests are given each quarter in elementary school, and each semester (two times per year) in junior and senior high school.	Yes	Given for the final grade for each school level to determine the graduation of students. Geography one of the subjects included in the test.
<b>Israel</b>	10 years	Yes	Yes	Badly
<b>Italy</b>	10 years	No	No	No



Country	How many years of education are compulsory or what level of education is compulsory?	Are there local, regional or national tests, which provide baseline information on student learning in the earth sciences or geosciences	Are these tests compulsory?	How are the resulting test data used?
Japan	Grade 9	<p>Nationwide assessments on academic abilities and study habits; survey for curriculum implementation.</p> <p>A survey on specific curriculum issues was conducted in the test for 13% (150,000 students) of upper secondary 12<sup>th</sup> graders in 2003 and 2005 respectively. About 6000 of the 12<sup>th</sup> graders took the Earth science I test.</p> <p>Through taking the initiative in developing assessment tools based on the principles of the standards, in implementing assessment, and in distributing explanations of the assessment, the MEXT publishes the principles of the standards.</p>	No	To diagnose student achievement levels and for developing the new curriculum.
Korea	Grade 9	<p>National level 'student achievement test' for 6<sup>th</sup> graders, 9<sup>th</sup> graders, and 10<sup>th</sup> graders every year in Earth science. However, this achievement test is implemented with only 1% of the whole population for the 6<sup>th</sup> and 9<sup>th</sup> graders, and 3% for the 10<sup>th</sup> graders.</p>	Yes	To diagnose student achievement levels and investigate school differences.

<b>Country</b>	<b>How many years of education are compulsory or what level of education is compulsory?</b>	<b>Are there local, regional or national tests, which provide baseline information on student learning in the earth sciences or geosciences</b>	<b>Are these tests compulsory?</b>	<b>How are the resulting test data used?</b>
<b>Malawi</b>	None	Yes, national examinations at Primary school level (Grade 8) and at Secondary level (Form 2 and 4) and all years at University	Yes, for those taking the option	To select students for higher-level education. i.e. Grade 8 for Secondary Education entry, Form 2 for Form three entry and Form 4 for University entry and earning university degree at University
<b>New Zealand</b>	Up to age 16 years	Criterion- based assessment examinations, years 11-13	No but nearly all will attempt. An element of choice.	National Certificate of Educational Achievement (NCEA). University entrance Scholarships. Entrance to tertiary education.
<b>Norway</b>	10 years compulsory, 13 years recommended 6-19 year olds	Grade 10, 11, 12 and 13.	Yes, but only a cohort is selected.	Students need them to enter higher education and they are used to provide statistics/ information for authorities and schools.
<b>Philippines</b>	Kindergarten to grade 12, 13 yrs	None yet	Not applicable	Not applicable
<b>Portugal</b>	12	No		
<b>Romania</b>	10 years	Yes	Yes	
<b>Russia</b>	11 years	Yes, national tests (at 9 and 11 grade)	Yes	National Certificate of Educational Achievement, University entrance
<b>Saudi Arabia</b>	16 years old			
<b>Scotland</b>	Years 5-16	No		
<b>South Africa</b>	Grades 1 – 9 (about 7 to 14 yrs)	They start writing exams in Grade 4 which include an Earth Science component.	Yes	They are used to promote learners to the next level

<b>Country</b>	<b>How many years of education are compulsory or what level of education is compulsory?</b>	<b>Are there local, regional or national tests, which provide baseline information on student learning in the earth sciences or geosciences</b>	<b>Are these tests compulsory?</b>	<b>How are the resulting test data used?</b>
<b>Spain</b>	10 years Primary (6-12) Compulsory Secondary (12-16)	National tests only to access university	No	University entrance/ selection
<b>Sri Lanka</b>	11 years	No	-	-
<b>Taiwan</b>	9 years 15 years old	Yes	Yes	Only used in combination with other science subjects to screen students for science tracks.
<b>Trinidad &amp; Tobago</b>	11 years	Yes, O levels and A levels	Yes but geography and science are not	Not sure
<b>United States</b>	Established by the states, but generally education is compulsory until age 16.	Nothing specific to geology.	Generally not in science, only maths and language arts.	
<b>Uruguay</b>	9 years	No		

**Comment on the educational system background**

- Are optional earth science or geoscience courses offered in schools/colleges?
- At what age are they available?
- Are they available to all/most/a few/hardly any pupils across the system?
- What curriculum/syllabus do they offer – all the same/several different ones/a wide variety?
- Do earth science/geoscience courses satisfy college or university science entrance requirements?

Country	Are optional earth science or geoscience courses offered in schools/colleges?	At what age are they available?	Are they available to all/ most/ a few/ hardly any pupils across the system?	What curriculum/ syllabus do they offer – all the same/ several different ones/ a wide variety?	Do earth science/ geoscience courses satisfy college or university science entrance requirements?
<b>Argentina</b>	No				
<b>Australia</b>	Yes	16-18 year olds	Small number	Varies from state to state	Yes
<b>Bangladesh</b>	No Earth science or geoscience courses are offered in pre-college education except in geography. But general science, which is a requirement for all levels of pre-college education, contains some basic / fundamental topics on some aspects of geology, soil science, environmental science, agronomy, biological science etc. In most schools, geography is taught as a separate subject but is not compulsory for all students and for all schools.	No geoscience courses are offered at pre-college level and so there is no standard curriculum.			As there is no geoscience in the syllabuses of school or college level education, students enter or admit themselves to the department of geosciences at universities without basic knowledge except in case of departments of geography. But during their entrance to geoscience departments in universities, it is mandatory for the student to take an exam on basic science, on a competitive basis.
<b>Belgium</b>					

<b>Country</b>	<b>Are optional earth science or geoscience courses offered in schools/colleges?</b>	<b>At what age are they available?</b>	<b>Are they available to all/ most/ a few/ hardly any pupils across the system?</b>	<b>What curriculum/ syllabus do they offer – all the same/ several different ones/ a wide variety?</b>	<b>Do earth science/ geoscience courses satisfy college or university science entrance requirements?</b>
<b>Brazil</b>	No, but mining courses and environmental sciences training is available in some technical colleges	For 17-19 year olds	Few		No courses but some related questions in exams

Country	Are optional earth science or geoscience courses offered in schools/colleges?	At what age are they available?	Are they available to all/ most/ a few/ hardly any pupils across the system?	What curriculum/ syllabus do they offer – all the same/ several different ones/ a wide variety?	Do earth science/ geoscience courses satisfy college or university science entrance requirements?
Canada	Yes All	High School (Grades 11,12), first year college and university ON High School (Age 16-18) NF High School (Age16-18) and an Alternative Geology in Grade 11 is being piloted (Calgary) AB Grade 10, 11, 12 NT Age 16-17+ SK Grade 11, 12 (Age 16-18) Earth Science 11, Geology 12 BC Age 14-18 YK University age >17 years NB	Hardly any, although technically available to all, courses are not offered in many schools and not online. Earth science is not a teachable subject so the number of teachers qualified to teach Earth science is low ON Available to any student in schools that offer the course. A select number of schools will begin offering the course through distance education NL A few NT Optional geosciences courses currently only offered in about 10 schools, therefore only a few pupils SK Only offered in a small number of schools BC Most/not all schools offer Geoscience courses at Grade 11, 12 level YK All NB	Varied, including a Mining High Skills Program, geologic time, overview and history of geology, natural disasters, environmental earth science ON Provincial curriculum/syllabus for Earth Systems 3209 is the same for any student NL Broad geology AB Education councils have the option of developing locally relevant geosciences courses NT Energy and Mines 10, 20, 30 – curriculum the same across the province (a different geology course offered in one school) SK Standard provincial curriculum BC Same curriculum YK Varied NB	Yes ON, NL They are equivalent to other Grade 12 science courses but must compete with these science courses for uptake. Earth and Space Science SES4UI is now aligned with first year at the University of Waterloo ON Yes, but physics, chemistry or biology are preferred BC Yes for some universities YK Yes for College, Variable/no for University NT No AB, SK

Country	Are optional earth science or geoscience courses offered in schools/colleges?	At what age are they available?	Are they available to all/ most/ a few/ hardly any pupils across the system?	What curriculum/ syllabus do they offer – all the same/ several different ones/ a wide variety?	Do earth science/ geoscience courses satisfy college or university science entrance requirements?
<b>Czech Republic</b>	Very rarely	They could be offered to students at age 17-19 – during the last two years of their high school study – as a seminar.			There are no requirements there is no subject called Earth science.
<b>England</b>	Yes	16 – 18 year olds	Hardly any	Two syllabuses available	Yes
<b>Estonia</b>	No				Yes
<b>Finland</b>	Yes	16-18	To all	Two courses: Regional studies and GIS and Geography of risks and possibilities (global threats)	Yes (the problem is the declining number of students who study geography, now that it has become optional)
<b>France</b>	No Only the Earth science in the official curriculum				
<b>Germany</b>	Yes (depends on the Federal State)	10-16	No	A wide variety	No
<b>India</b>	No in school, Yes for colleges	19 year olds	A few	A wide variety	Yes

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<b>Indonesia</b>	General high schools do not have optional Earth science or geoscience courses. This is accommodated in geography.  Technical High Schools offer mine and geology courses from the 1 <sup>st</sup> - 4 <sup>th</sup> year.	15/ 16-18/ 19 years old (schools)	Only for those who take Technical High School courses.	Same	There are no special requirements in Earth science subjects.
<b>Israel</b>	Yes	16-18	Few	All the same	Yes
<b>Italy</b>	No	No	No	No	No



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Japan	<p>For the 10<sup>th</sup> to 12<sup>th</sup> graders as an elective courses, Earth science I for 10<sup>th</sup> to 11<sup>th</sup> graders</p> <p>Earth science II (Advanced) for 11<sup>th</sup> to 12<sup>th</sup> graders</p>		Theoretically, it's available to any pupil who wants to take the course. However, students who want to major in Earth science-related studies at university take these elective courses.	Same	Some students take elective courses in Earth science and take college entrance 'Earth science' exams with other chosen science courses (around 5 to 6% of all students chose Earth science I electively at upper secondary school in 2003; around 4% of all students chose Earth science I as one of their college entrance exam areas in 2008).

Country	Are optional earth science or geoscience courses offered in schools/colleges?	At what age are they available?	Are they available to all/ most/ a few/ hardly any pupils across the system?	What curriculum/ syllabus do they offer – all the same/ several different ones/ a wide variety?	Do earth science/ geoscience courses satisfy college or university science entrance requirements?
<b>Korea</b>	For the 11 <sup>th</sup> and 12 <sup>th</sup> graders as an elective courses.	16 years -18 years old at high school.	Theoretically, it's available to any pupil who wants to take the course. Students who want to major in Earth science-related studies at university take these elective courses. There are few students who select Earth science for their major to enter university, so there are fewer Earth science teachers compared to the number of other science teachers like physics, chemistry, and life science.	Same	Some students take elective courses in Earth science and take college entrance 'Earth science' exams with other chosen science courses (around 17% of all students chose Earth science I as one of their college entrance exam areas in 2004).
<b>Malawi</b>	Yes	On completion of secondary education; in most cases after the age of 16	All science students but are optional.	Varies from Year 1 up to Year 4. It's mainly the strength of the material at each of these levels that varies.	Yes
<b>New Zealand</b>	Yes, but school-determined Now very reduced to almost nothing.	Years 11-13	No, depends on school	National Curriculum	Yes
<b>Norway</b>	Yes	17-19 Year olds, Grade 12 and 13.	Depends on the schools.	National Curriculum	Yes

<b>Country</b>	<b>Are optional earth science or geoscience courses offered in schools/colleges?</b>	<b>At what age are they available?</b>	<b>Are they available to all/ most/ a few/ hardly any pupils across the system?</b>	<b>What curriculum/ syllabus do they offer – all the same/ several different ones/ a wide variety?</b>	<b>Do earth science/ geoscience courses satisfy college or university science entrance requirements?</b>
<b>Philippines</b>	Yes	13+	No. Only the Philippine Science High School system and Science – oriented high Schools offer the subject “Earth Science” or “Environmental Science”. Ordinary schools (public or private) do not have this subject.	Several different ones	No
<b>Portugal</b>	In some professional schools.				No
<b>Romania</b>	Yes	11-18			Yes
<b>Russia</b>	Yes	Secondary school level	Students who want to major in Earth science-related studies at university take elective courses.	They are included into secondary school curriculum	Not enough
<b>Saudi Arabia</b>	No	University	Only to less able students		

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<b>Scotland</b>	Yes	14+	Geology - few Geography - most	Scottish Qualifications Authority Standard Grade and Higher Still: Geography Scottish Qualifications Authority Higher Still: Geology A-Level and GCSE Geography at some schools in the independent sector (various exam boards)	Geography is required for Geography and related degrees; Geology is not an entrance requirement for Geology
<b>South Africa</b>	No But some coverage in Geography and Life Sciences	Grades 10 to 12 (about 16 to 18)	Many learners take Geography and Life Sciences	All the same-strictly prescribed curriculum-though some variation between Independent and Government schools	Universities in South Africa are more interested in the learners' Maths, Physical Science and English results - and overall scores, than Geography and Life Sciences
<b>Spain</b>	Yes	16-18 year olds	Only to science branch pupils	The same	Yes
<b>Sri Lanka</b>	No (available only few topics and not as a subject)	These topics are introduced at about year 14 - 18	Common to year 14 – 16 and year 16 – 18 science and geography students	Several different ones	No
<b>Taiwan</b>	Yes	Years 11 and 12		Same	Yes

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<b>Trinidad &amp; Tobago</b>	At primary level some Earth science is taught through science; at secondary level it is taught through Geography	To most pupils across the system		Primary science and the secondary geography; same across the system. Currently there is no national geography syllabus for pupils aged 11-13 (Forms 1 and 2).	A-Level geography could satisfy entrance into the university's geography degree program, together with other subjects.
<b>United States</b>	Available in some schools.	Varies Some schools offer an Earth Science course in year 6 – 8, some offer a capstone course to year 12 students.	Depends on the school.	Depends on the school.	Variable. Some universities/ colleges do accept geology others do not.
<b>Uruguay</b>	No				Yes

#### Summary of 'optional geoscience education courses' data

Country	Are optional earth science or geoscience courses offered in schools/colleges?	At what age are they available?	Are they available to all/ most/ a few/ hardly any pupils across the system?	What curriculum/ syllabus do they offer – all the same/ several different ones/ a wide variety?	Do earth science/ geoscience courses satisfy college or university science entrance requirements?
<b>Total/33</b>	<b>21 = 64%</b>	<b>Mostly 16-18 year olds</b>	<b>Generally small numbers</b>	<b>No summary possible</b>	<b>Mostly 'yes'</b>

### EARTH SCIENCE OUTREACH

- Which organizations/strategies promote earth science outreach in your country/region?
- Indicate how effective each is by: Very effective; Effective; Fairly effective
- Indicate how widespread each is by: Very widespread; Widespread; Fairly widespread

Country	Museums	Interactive science centers	National parks	Parks with an Earth Science focus	Networks protecting Earth science sites	Public understanding organizations focusing on Earth science	Local "rockhound" group	Group aimed at children	Earth science content in local Public Understanding of Science Events
<b>Argentina</b>	Most geological and paleontological museums are not active in terms of modern education and outreach programs.								Only the University of Buenos Aires organizes a very successful Earth science week, since the year 2000.
<b>Australia</b>	Effective; Widespread. Most state museums have Earth science exhibits and educational programmes	Effective; Widespread. Interactive Centres in most State capital cities	Fairly effective; Fairly widespread. Many parks have geology interpretation. Quality is variable	None yet	The Australian Geological Society has a Heritage sub-committee		Fairly effective; Fairly widespread. Field Geology clubs and mineral collector groups.		

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Bangladesh	Dhaka National Museum sometimes arranges educational programs / lectures on different aspects of science including geosciences to give some idea / knowledge to the students of different school and college levels of education. They invite guest speakers and students from different educational institutes for this purpose.					Dhaka National Museum often arranges mobile educational programs on different aspects including some topics on geosciences or Earth science for the people of remote areas, to improve public understanding			

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<b>Belgium</b>	Very effective; Very widespread. Musée des Sciences Naturelles de Belgique (Bruxelles)	Very effective; Widespread Eurospace Center (Redu)							



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<b>Brazil</b>	Very effective; Widespread. Mineralogy Museum Escola de Minas - Universidade Federal de Ouro Preto	There are some interactive science centers (in a broad sense, but quite few on Earth Sciences) maintained both by private educational institutions or by state governments.	Fairly effective; Fairly widespread. There are 76 national parks in Brazil. Many of the national parks include trained people to help visitors to get knowledge on specific aspects of the local regions. One in the State of Paraíba – is focused on dinosaurs One is in the State of Ceará with a good collection of Cretaceous fossils in limestones of the Araripe Basin.	State of São Paulo – focused on evidence of the Permian-Carboniferous glaciations of the Paraná Basin. State of Rio Grande do Sul – focused on Mineralogy. State of Minas Gerais – focused on dinosaurs. State of Santa Catarina – focused on paleontology.	SIGEP is the relevant nationwide mechanism for defining official sites as well as strategies for protecting Earth science sites. SIGEP is the Brazilian Commission of Geological and Palaeobiological Sites It is linked to the following entities: UNESCO – World Heritage Committee (WHC); IUGS - International Union for the Geological Sciences; IGCP - International Geological Correlation Programme; IUCN - International Union for the Conservation of the Nature; Working Group on Geological and				There are some small places dedicated to geological monuments spread across different states – visited by tourists, teachers and pupils. Examples include: Park of the Permian-Carboniferous Moutonnée Rock in Salto and Park of the Permian-Carboniferous Varvite Rock in Itu, both situated in Sao Paulo State.

Country	Museums	Interactive science centers	National parks	Parks with an Earth Science focus	Networks protecting Earth science sites	Public understanding organizations focusing on Earth science	Local "rockhound" group	Group aimed at children	Earth science content in local Public Understanding of Science Events
Canada	Fairly effective; Royal Ontario Museum ON Very effective; Science North ON) U of Waterloo Earth Sciences Museum ON Fairly effective; Canadian Museum of Nature Effective: Widespread; The Rooms Provincial Museum NL Glenbow Museum AB Royal Alberta Museum AB Very effective; Royal Tyrrell Museum AB	Fairly effective; Ontario Science Centre ON Very effective: Widespread Johnson GEO CENTRE NL Fairly effective: Widespread; Manuels River Interpretation centre NL Telus Spark Calgary and Telus Centre Edmonton AB Very effective; Fairly widespread Science Centre SK E;VW Science World BC Okanagan Science Centre BC	Many national parks in Canada but geology interpretation is generally poor with the exception of a few such as Gros Morne NL, Fundy NB, and Jasper AB and Grasslands SK, for which GeoVista brochures have been developed ( to educate both the public and help to train interpreters <a href="http://www.earthsciencesCanada.com/geovista">http://www.earthsciencesCanada.com/geovista</a> )	Very effective: Widespread Gros Morne National Park NL Fairly widespread: Dinosaur Provincial Park and other parks in AB have minor geoscience Fairly effective; Fred Henne Park Prospectors Trail NT Very effective; Grasslands National Park SK Fairly effective; Friends of Dempster Tombstone Memorial Park YK	Friends of Canadian GeoHeritage (CGEN) Ottawa Gatineau Geoheritage ON World Heritage Sites: Mountain Parks BC/AB (Banff, Yoho, Kootenay and Jasper) Burgess Shale in Yoho BC Effective; NT Mining Heritage Society Fairly effective; some provincial, municipal and government organisations NB	Very effective; Fairly widespread Canadian Geoscience Education Network (CGEN) <a href="http://www.earthsciencesCanada.com/CGEN">www.earthsciencesCanada.com/CGEN</a> Very effective; widespread Mining Matters ON Calgary Science Network ( <a href="http://www.calgaryscienceNetwork.ca">http://www.calgaryscienceNetwork.ca</a> ), and similar organizations in Medicine Hat, Lethbridge, Red Deer, Edmonton	Very effective; many local groups (rock hounds, rock and mineral clubs, field naturalists) Alberta Paleontological Society and Calgary Rock and Fossil Show AB Effective; NWT Mining Heritage Society NT Effective; NWT Rockhounds	Effective: Very widespread Let's Talk Science ALL University Science Camps (e.g. SK, Science venture BC) E;W Young Toronto Mineralogists Club Very effective; Very widespread Mining Matters ON Johnson GEO CENTRE Geological Interpretive Centre NL Alberta Science Literacy Association ( <a href="http://www.asla.ca/">http://www.asla.ca/</a> ) AB Very effective; Geoscience Education Connection NT	National Geoscience and Engineering Week ALL Oceans Week ALL Geoheritage Day ON Fairly effective: Fairly widespread Open houses at local mining operations ON Mining Week NL Oil and Gas Week NL Earth Science for Society AB Very effective; Geoscience Education Connection NT VE; Tundra Science and Culture Camp NT

Country	Museums	Interactive science centers	National parks	Parks with an Earth Science focus	Networks protecting Earth science sites	Public understanding organizations focusing on Earth science	Local "rockhound" group	Group aimed at children	Earth science content in local Public Understanding of Science Events
<b>Canada cont.</b>	Effective; Prince of Wales Northern Heritage Centre NT Effective; local Museum of Natural Science SK Very effective; T-Rex Centre SK Fairly effective; Widespread Royal BC Museum BC Pacific Museum of the Earth UBC BC Effective; MacBride Museum YK Effective; Copperbelt Museum YK Fairly effective; New Brunswick Museum NB Fundy Geological Museum NS Miller Museum of Geology ON Virtual Museum of Canada	Very effective; Science East NB Canadian Petroleum DiscoVery effectiv Centre AB		Fairly effective; Irving Nature Park, Rockwood Park, Dominion Park, Fundy Trail, Lepreau Falls NB		and Grand Prairie AB Very effective; local Geological Society SK Effective: Widespread SK Mining Association Effective; local Geological Survey SK Very effective; Widespread Geological Survey YK Fairly effective; Stonehammer Global Geopark NB	Young NT Naturalists Club NB	Very effective; Geoscience Office Outreach Geologist NT Geological Society SK Very effective: Widespread Mining Association SK Very effective: Fairly widespread Mineral Education Program of BC Effective: Fairly widespread Summer camps Yukon College YK, Yukon Wildlife Preserve YK FE; Stonehammer Global Geopark NB Scouts Canada and Girl Guides Canada have geology badges	Very effective: Widespread Yukon Chamber of Mines, Yukon Geological Survey, Department of Energy, Mines and resources, Yukon College YK

Country	Museums	Interactive science centers	National parks	Parks with an Earth Science focus	Networks protecting Earth science sites	Public understanding organizations focusing on Earth science	Local "rockhound" group	Group aimed at children	Earth science content in local Public Understanding of Science Events
<b>Czech Republic</b>	Effective; Widespread. National Technical Museum		Fairly effective; Widespread. Krkonoše – The Great Mountains National Park	Many parks around the country – tourist paths with information tables about nature.		Magazines with geological topics: National Geographic Czech Republic Edition and Koktejl (Czech Republic magazine for geography).		Clubs for children in every town	

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<b>England</b>	Effective; Fairly widespread. Natural History Museum, London			Fairly effective; Fairly widespread. Jurassic Coast Dorset and East Devon Heritage Site.	Effective; Widespread. Regionally Important Geological and Geomorphological Sites (RIGS) groups across the country.		Effective; Widespread. The Geologists' Association (GA) has local groups of mainly amateurs with lectures, field meetings and publications	Rockwatch, run by the Geologists' Association, <a href="http://www.rockwatch.org.uk">www.rockwatch.org.uk</a>	Both the GA and the Earth science Education Unit (through its ambassadorial work) seek to support local Public Understanding of Science events to give an Earth science dimension
<b>Estonia</b>	Effective; Widespread. Estonian Museum of Natural History; University of Tartu Museum of Geology	Fairly effective; Widespread. Estonian Science Centre AHHAA <a href="http://www.ahhaa.ee/">http://www.ahhaa.ee/</a>	Fairly effective; Widespread. Lahemaa National Park	Fairly effective; Widespread. Nature Parks					

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<b>Finland</b>	Very effective	Very effective	Effective	Effective	Effective <a href="http://www.geologia.fi">www.geologia.fi</a> by the Finnish National Union of Geological Sciences		Fairly effective	Fairly effective Too little activity here. Focus on teaching the geography teachers.	Fairly effective Mainly targeted, like national Geology Day
<b>France</b>	Effective; Fairly widespread.	Effective; Fairly widespread.	Fairly effective; Fairly widespread.	Fairly effective; Fairly widespread	Fairly effective; Fairly widespread.	Fairly effective; Fairly widespread.			
<b>Germany</b>	Fairly effective; Widespread.	Fairly effective; Fairly widespread		Fairly effective; Fairly widespread					
<b>India</b>	Science planetariums, GSI, Bangalore	Effective		Effective		Fairly effective		Fairly effective	Fairly effective

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Indonesia	Fairly effective; Fairly widespread. <ul style="list-style-type: none"> <li>Geological Museum in Bandung, West Java</li> <li>Geological and Paleontological Museum in Sangiran, Central Java</li> <li>Biological Museum in Jakarta</li> <li>Biological Museum in Yogyakarta</li> </ul>	Effective, Fairly widespread. Only two "well established" science centers: <ul style="list-style-type: none"> <li>SC in Taman Mini, Jakarta</li> <li>SC in Taman Pintar, Yogyakarta</li> <li>Planetarium in Jakarta</li> <li>Observatorium in Bandung owned by Bandung Institute of Technology</li> </ul>	Fairly effective; Fairly widespread. Geological field Karangsambung, Central Java owned by the Indonesian Science Agency (LIPI). Proposed as a national geological park, or geography.  There are a lot of "Biological" Natural Parks throughout the country.	Fairly effective; Fairly widespread. <ul style="list-style-type: none"> <li>Geological field Karangsambung, Central Java</li> <li>Geological field Bayat, Central Java owned by Gadjah Mada University</li> </ul>	Effective, Widespread. The Indonesian Geologist Association has a special section promoting the protection of Earth science sites by labels of "Geotourism". Local governments are always involved to promote and organise the geotourism sites.  Other professional associations related to Earth science usually also have these kinds of programs.	Effective, Widespread. Formal Earth science-related organisations like the Indonesian Geologist Association or government agencies/universities/schools have community service programs which focus on improving public understanding of Earth science. A lot of non-governmental organisations are established mostly working on geohazard mitigation.	Effective, Widespread. The Indonesian Geologist Association has local groups throughout Indonesia.  There are many amateur groups which focus on nature protection.	Fairly effective, Fairly widespread. No special groups are aimed at children. Earth science early education is usually attached to school activities including at playgroup and kindergarten levels.	Effective, Widespread. Earth science-related institutions like government agencies/universities/schools usually hold regular 'open house' events or are involved in many public activities/events by running booths to distribute information. A lot of non-governmental organizations are quite active as well, by running events related to geo/nature protection (not necessarily science events).
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Country	Museums	Interactive science centers	National parks	Parks with an Earth Science focus	Networks protecting Earth science sites	Public understanding organizations focusing on Earth science	Local "rockhound" group	Group aimed at children	Earth science content in local Public Understanding of Science Events
<b>Israel</b>	Fairly effective; Fairly widespread.	Fairly effective; Fairly widespread.	Fairly effective; Fairly widespread.	Fairly effective; Fairly widespread.	Fairly effective; Fairly widespread.	Fairly effective; Fairly widespread.	Fairly effective; Fairly widespread.	Fairly effective; Fairly widespread.	Fairly effective; Fairly widespread.
<b>Italy</b>	Very effective Widespread. There are several museums, one really active it is: Museo Tridentino di Scienze Naturali <a href="http://www.mtsn.tn.it/">http://www.mtsn.tn.it/</a>	No	Fairly effective Fairly widespread. Italian Geopark network	Fairly effective Fairly widespread. Italian Geopark network	Fairly effective Fairly widespread. ISPRA – Istituto Superiore per la Protezione e la Ricerca Ambientale  Effective; Very widespread. Geology and Tourism association <a href="http://www.geologiaeturismo.it/node/166">http://www.geologiaeturismo.it/node/166</a>	No	No	No	Effective Widespread. Federazione Italiana Scienze della Terra Geoitalia Onlus <a href="http://www.geoitalia.org/">http://www.geoitalia.org/</a>



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Japan	<p>Effective; Fairly widespread. National Science Museum , Tokyo</p> <p>Prefectural Natural History and Science Museum</p>	<p>Effective; Fairly widespread. National Museum of Emerging Science and Innovation (Mirai-Kan) is a newly opened science museum (in 2001). The museum is to be the center for promoting public understanding of science and technology and fostering human resources in Japan.</p> <p>Prefectural Science Center</p>	<p>Fairly effective; Fairly widespread. Many parks have geology interpretation. Quality is variable</p>			<p>Geological Survey of Japan</p>			

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<b>Korea</b>	Very effective; Very widespread. There are six National science museums which include Earth science content in metropolitan cities. And there are almost 100 public and private science museums which contain Earth science.	Fairly effective; Fairly widespread. There are science centers with the focus on Earth science. For example, geology, oceanography, astronomical centers etc. These centers have an exhibition hall so that visitors look around; centers sometimes provide chances to meet real scientists who work at those centers. There are many programs so that students and the general public can experience	Fairly effective; Fairly widespread. There are 20 national parks in Korea. Once people visit these national parks, there are 'interpreters' or 'docents' who volunteer in interacting visitors.	Fairly effective; Fairly widespread. Most National Parks focus on Earth science, especially geology, including minerals, rock formation, and the history of geology.	Fairly effective; Fairly widespread. There are some groups which protect Earth science sites, for example, Cheju National Park is appointed as national treasure by UNESCO. So the agency of the National Park is responsible for protecting parks from visitors for preservation.	Very effective; Very widespread. There is very structured governmental agency: KOFAC (Korean Foundation for the Advancement of Science and Creativity) which was renamed as KOFAC in 2008, but founded in 1967. There are many youth festivals and programmes for students and teachers in the field of Earth science as well as other science areas. This is the main engine for the Public Understanding of Science (PUS).	Fairly effective Fairly widespread. There are some ministry study groups on geology and geophysics related to mines, natural resources, minerals and rocks.	Fairly effective Fairly widespread. There some groups developed by schools, centers, and science museums for students who are interested in being geologists or geophysicists.	Fairly effective; Fairly widespread. There are local PUS events offered by KOFAC and MEST (Ministry of Education of Science and Technology). Students and general citizens attend these local events of PUS at local science museums or schools. Examples include: YSC (Youth Science Camp) and WISE (Women in Science and Technology) funded by KOFAC and MEST.

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Malawi							Fairly effective. Geological Society of Malawi		
New Zealand	In all main cities and rural towns Te Papa at Wellington	Christchurch	Only minimal	No. Tongariro National Park (Volcanoes)	?	?	?	?	?
Norway	Natural History Museums, Glacier Museum, the silver mines  Offering teaching services to schools; teaching programmes	Yes  Offering teaching services to schools; teaching programs		Geoparks: Gea Norwagica, Magma  Offering teaching services to schools		The Geology Day (annual outreach arrangement by the Norwegian Geol Survey, activities are offered in several Norwegian cities).		Museums and organisations have geology groups for children	Regional organisations provide information about local geology, various outreach initiatives.
Philippines	Effective UP NIGS Museum	Effective The Mind Museum	Effective Palawan Subterranean River (new Seven Wonders of the World).			Effective Through the national selection for IESO Lecture series in the Earth Sciences.	Fairly effective Groups based in the university	Fairly effective Interschool Earth Science Quiz for elementary organised by the author (7 <sup>th</sup> year in 2012).	Very effective, especially if the media are involved

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<b>Portugal</b>		Effective, Widespread.		Effective, Widespread.					
<b>Romania</b>	Effective; Widespread.	Fairly effective; Fairly widespread.	Effective; Fairly widespread	Fairly effective; Fairly widespread.	Fairly effective; Fairly widespread.	Fairly effective; Fairly widespread.	Fairly effective; Fairly widespread.	Fairly effective; Fairly widespread.	Fairly effective; Fairly widespread.
<b>Russia</b>	Geological museums of different levels and regional museums of local lore.	Planetarium	None of the national parks have an Earth science focus.	Biosphere parks and systems of protected territories of different levels.		Magazine "Geography at school".	There are groups dedicated to the preservation of Nature.	Town clubs of science and culture for children.	Low percentage.
<b>Saudi Arabia</b>	Fairly effective; Fairly widespread. University Museums.	Fairly effective. Jeddah Science Technology Center.	Effective; Widespread. SGS						

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<b>Scotland</b>	National Museums of Scotland special national projects are Effective and Widespread, but day-to-day outreach much less so.	I don't think any do Earth science outreach and only one or two do any outreach, locally.	Scotland's national parks are just starting work; one Earth science visitor centre in North West Scotland.		UK Regionally Important Geological and Geomorphological Sites (RIGS). Local groups; Lothian and Borders area do good work; not sure about others; patchy.				

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South Africa	Unassessed Generally of local impact Both University, Government and Municipal Natural History Museums all have an Earth science component	Unassessed Generally of local impact with no large Earth science component Local, National Government or Corporate Sponsorship	Unassessed Generally of local impact Corporate sponsorship	<b>Cradle of Humankind World Heritage Site</b> Attracts many visitors, school children and teachers. Attracts visitors Internationally and nationally. Impact is unassessed. <b>West Coast Fossil Park</b> Focuses on Miocene/ Pliocene fossils – attracts tourists and local visitors has attracted large funding and will be reworked. Also there are a few under development <ul style="list-style-type: none"> <li>• Tswaing Meteorite Crater</li> <li>• Vredefort Dome World Heritage Site</li> <li>• Golden Gate National Park</li> </ul>	Geological Society of South Africa- Geoheritage working group – still on a small scale South African Heritage Resource Agency protects fossils and meteorites	None	Federation of Southern African Gem and Mineralogical Societies 600 membership nationwide, With monthly meetings, outings etc.	Some Assessment Local Partially successful	Many lectures- often at too high a level for general public Lectures may be organised by the Geological Society and subsidiaries and Universities. Unassessed. Generally of local impact but do maintain the interest of enthusiasts  South African Association of Science and Technology Organises National Science Week which may have an Earth science Component  Sasol Expo and Science Fest are two regional science festivals which are well attended and have an Earth science component Independent of the contributors Effective in raising enthusiasm

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<b>Sri Lanka</b>	Geological Society of Sri Lanka – Very effective, Widespread. Department of Geology – Very effective, Widespread.	Mainly in two or three main cities (not much about Earth science-related materials)	In main cities	None	None	No	-		
<b>Spain</b>	Very effective; Widespread. Museo de Geología (Madrid and Barcelona). IGME Museum (Madrid)	Very effective; Fairly widespread. Cosmocaixa (Madrid and Barcelona) Science Museum (Valencia)	Effective; Very widespread. Natural Parks throughout all the country (ex: Parc Natural del Montseny)	Effective; Fairly widespread. Several Geoparks across the country.	Effective; Fairly widespread. Several Geoparks across the country.	No such organisation	Usually as part of hiking societies	No such organisation	Very effective; Very widespread. Geolodays are very successful. Organised in about 50 cities with the participation among others of AEPECT.
<b>Taiwan</b>	Fairly effective, Fairly widespread.	Effective, Fairly widespread.	Very effective, Widespread.	Very effective, Widespread.	Effective, Widespread.	Effective, Fairly widespread.	Very effective, Fairly widespread.	Effective, Widespread.	

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<b>Trinidad &amp; Tobago</b>	National Museum has some Earth science content; there are no outreach initiatives.	Effective, Widespread. Travelling exhibits, science club, national science fairs	None of the National parks have an Earth science focus	None of have an Earth science focus	None exist	Effective, Fairly widespread . Travelling exhibits, public/school lectures.	No.	There are no specific groups aimed at children which promote Earth science.	



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<b>United States</b>	Effective, Widespread. Nationally the Smithsonian Institute has many exhibits and a broad web presence. Many states, municipalities and other organisations have museums, often with a web presence.	Effective, Widespread. Many museums have interactive science exhibits.	Effective, Widespread. Many of the US National Parks, particularly in the western states, have a 'geologic' aspect and exhibits and other information is available in visitor centers, guidebooks and from rangers about the geology.	Effective, Widespread. Somewhat difficult to separate national parks in general from parks with an Earth science focus. Parks such as the Grand Canyon are about geology, but the focus tends to be natural history in general. Some parks have been set aside to preserve fossil and other geologic resources.	No specific national network for protecting Earth science sites.	Effective, widespread. The American Geoscience Institute (AGI) works to promote public understanding of the Earth sciences. AGI publishes 'Earth', a monthly magazine about geoscience. AGI sponsors Earth Science Week (2 <sup>nd</sup> week of October) and develops materials for Earth Science Week.	Many local "rockhound" groups exist in the United States. The American Federation of Mineralogical Societies is a link to these many groups.	No national groups directed at children, but many of the professional societies have outreach programs (and web pages) for children. Many of the "rockhound" groups have "kids programs."	A number of local geological societies participate in public 'science' events.

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<b>Uruguay</b>	Very effective; Very widespread. Museo de Geología del Uruguay Museo de Geociencias de Tacuarembó					Very effective; Very widespread. Dirección Nacional de Minería y Geología  Facultad de Ciencias - Departamento de Evolución de Cuencas y Departamento de Geología y Paleontología	Very effective; Very widespread. Grupo de Estudios y Reconocimiento Geográfico del Uruguayn (GERGU) Centro de Estudios de Ciencias Naturales (CECN) There are very active groups dedicated to preservation and environmental education.	Colegio CENI  Colegio Pio	

**Summary of the 'Earth science outreach' data**

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<b>Totals/33</b>	<b>28 = 85%</b>	<b>21 = 64%</b>	<b>18 = 55%</b>	<b>17 = 52%</b>	<b>11 = 33%</b>	<b>12 = 36%</b>	<b>14 = 42%</b>	<b>13 = 39%</b>	<b>12 = 36%</b>

- Which earth science outreach programs have been particularly successful?

Country	Program	Program description including support structures	Likely reasons for success
Argentina	Earth Science Week at the University of Buenos Aires	Open labs, big exhibition, conferences and workshops	Very attractive exhibition and hands on activities, collaboration of students that work as “guides”
Bangladesh	Bangladesh National Museum has, from time to time, arranged and developed educational programs which include Earth science or geoscience topics or materials for students all over the country. This museum also carries out mobile educational programs in some remote areas so that unprivileged students can receive equal opportunities to learn.		
Belgium	<ul style="list-style-type: none"> <li>▪ Exposition “Dinosaures” - Musée des Sciences Naturelles - Bruxelles</li> <li>▪ Exposition permanente - Musée africain Tervueren</li> <li>▪ Expositions minéralogiques temporaires</li> </ul>		
Brazil	“Caminhos Geologicos: Educacao em Geociencias” (“Geology tracks: Geoscience Education”)	The government of Rio de Janeiro State is actively implementing a broad program of diffusion for the population in general of the knowledge of many geological monuments, as for example the Sugar Bread Mountain (the world-famous Pao-de-Acucar, in the Guanabara Bay). Parana and Bahia States have also some outstanding investments to promote related programs of scientific divulgation.	The so-called “Points of Important Geological Interest” are effectively nice places where Brazilian people and foreign visitors like to visit and to learn more about the origin, evolution, age, etc.

Country	Program	Program description including support structures	Likely reasons for success
<b>Canada</b>	<p>EdGEO teacher workshops</p> <p>Earth science focused National Parks, World Heritage Sites and recently Geoparks</p> <p>Canadian Geoscience Education Network (CGEN)</p>	<p>This is a national program which provides support (financial, curriculum-linked hands-on activity ideas and mentorship) for local earth science teacher workshops</p> <p>Earth science interpretation through associated museums (both physical and virtual) as well as public talks, fieldtrips, workshops and educational resources such as books, brochures and related websites</p> <p>CGEN is a collective of grassroots activists who develop and deliver outreach programs locally across Canada and who network together to encourage each other, provide support, raise funds and undertake initiatives together on a national scale.</p>	<p>By supporting teachers to teach Earth science with enthusiasm, through hands-on activity, and with good classroom resources we can capitalize on the potential to reach a huge number of students in a sustained and effective way</p> <p>These have enormous potential to raise the profile of Earth science in the public eye, and they are visited by many Canadians and visitors from other countries</p> <p>An excellent new website, engaging annual meetings and news bulletins bring together this diverse community of teachers, and educators/ outreachers from government, academia, industry and the non profit sector, to do together far more than could be accomplished by any one part.</p>
<b>England</b>	Earth Science Education Unit workshops	Short teacher education workshops offered to science and primary teachers across the UK through a network of ESEU facilitators	Targeted on the National Curriculum and containing a range of practical interactive activities

Country	Program	Program description including support structures	Likely reasons for success
France	EDUSISMO LITHOTHEQUE	Educational seismological network Regional Geosciences resources on web site	Partnership University - Research and education This is beginning, with strong early success
Germany	I feel no program is successful because I cannot find students which would be able to attend the IESO		
India	Earth Science Olympiad	Involves school students at XI standard	Nationwide coverage, good training at GSI Bangalore
Indonesia	<p>Geoscience course for geography teachers conducted by universities, museums or government agencies.</p> <p>Talks to local government officers and community by universities or government agencies, especially related to the community service program of each institution.</p>	<p>Lectures about geoscience accompanied by practical work in laboratories and excursions.</p> <p>Lectures about basic geoscience and geohazards and their mitigation. Activities conducted at local government offices. Usually linked to the "local wisdom" of each area.</p>	<p>Many geography teachers do not have good basic Earth science knowledge. This course is the best chance to improve their knowledge.</p> <p>Indonesia is a country which is vulnerable to many geohazards. Many people want to learn about geohazards and their mitigation.</p>

Country	Program	Program description including support structures	Likely reasons for success
<b>Israel</b>	The Weizmann's program	<p>This program focuses on dealing with all aspects of Earth science teaching:</p> <ol style="list-style-type: none"> <li>1. Knowledge, implementing Earth science in all learning environments (lab, outdoors, computers, classroom); dealing with learning strategies and how to deal with heterogenic classrooms and the variety of needs and orientations of students.</li> <li>2. Supporting the teachers in their schools and classes.</li> <li>3. Time-working with teachers for at least three years, until they can implement the programme independently. Teachers who leave the program early tend to ignore its implementation and all the investment is wasted.</li> </ol>	<p>The professionalism of our group in Earth science education.</p> <p>Unfortunately, to be professional in Earth science is not enough. The leaders of such a programme should be also be professionals in how to lead change among teachers.</p>
<b>Italy</b>	<p>Several initiatives took place during the International Year of Planet Earth (IYPE)</p> <p>Earth Learning Idea translations</p>	<p>Congress, seminars, conferences; a book about the Italian journey of Goethe, geosite and geopark, geology and wine, geoalps trail  <a href="http://www.viageoalpina.org/index3.php">http://www.viageoalpina.org/index3.php</a></p> <p>Several volunteer teachers translate the Earthlearningidea activities and spread them through workshops, as organized by ANISN: <a href="http://www.anisn.it">www.anisn.it</a></p>	Really effective activities.
<b>Japan</b>	Natural History Museums and Science Centers developed many programs.	Natural History Museums and Science Centers have many such programmes, such as: astronomical observation facilities, hands-on activities, science experiments and exhibitions.	

Country	Program	Program description including support structures	Likely reasons for success
<b>Korea</b>	<p>Science centers operated by the 'Science Education and Science Research Institute (SESRI)' that has the same status as the Metropolitan Office of Education (MPOE).</p> <p>National science museum/centers located in metropolitan areas play critical roles of providing various educational programs to different levels of visitors.</p>	<p>We have 16 'Science Education and Science Research Institutes (SESRI)' throughout the nation, and each has a 'Science (exhibition) Center'. The science centers provide users with 'astronomical observation facilities, hands-on activities, and other science exhibitions and experiments'.</p> <p>Science camps during weekends, winter and summer vacations, youth science festivals, science creativity competitions, and R and E (Research and Education) or R and D (Research and Development) by teams of teachers, students and professor.</p>	<p>The government puts emphasis on the importance of science and technology learning during school life.</p> <p>We do not have enough natural resources and we focus on human resource development.</p> <p>There is much funding supporting these events and programme.</p>
<b>New Zealand</b>	<p>Language of the Rocks Univ. of Canterbury Most University outreach programmes Royal Society initiatives Te Papa museum programmes</p>	<p>Resource materials and inservice training Lectures</p>	<p>Targeted on perceived demand and curriculum-based. Well presented. Free materials The main problem is keeping up to date with curriculum change.</p>

Country	Program	Program description including support structures	Likely reasons for success
<b>Norway</b>	5 year 'Geo program' sponsored by Statoil <a href="http://www.naturfagsenteret.no/c1480828/seksjon.html?tid=1488151">http://www.naturfagsenteret.no/c1480828/seksjon.html?tid=1488151</a>	<p>Four courses of professional development (15 ECTS each) for in-service Earth science teachers who teach the optional Earth science specialisation. The courses consist of 50% Earth science, and 50% Earth science pedagogy. The courses are offered by the Institute of Geoscience University of Oslo and the Norw Centre for science education.</p> <p>Design-based research project 'Geo Roots and Field Boots'</p> <p>Regional networks for in-service teachers led by Geo parks, university staff etc</p> <p>120 rock collections have been distributed to schools which offer the geoscience specialisation (Grade 12 and 13)</p>	<p>Long-term professional development courses that focus on how to teach Earth science (and not only Earth science matters). The participating teachers develop teaching activities; they try them out with their students and then use them as a basis for their final exams. This makes the courses relevant and meaningful for the teachers.</p> <p>Video observation of teaching and learning in Earth science, and redesign of the activities.</p> <p>Networks are an opportunity for teachers to meet other teachers and professional geoscientists.</p>
<b>Philippines</b>	National Selection for the International Earth Science Olympiad (IESO)	Organized by Prof. Miguel Cano of Bicol University in coordination with the Department of Science and Technology, Bicol University, University of the Philippines, Earth Science Teachers Association of the Phil, Vibal Publishing House and Hope Christian High School, and mining companies.	<p>Support structures present</p> <p>The Philippines successful hosting of the 2<sup>nd</sup> IESO became the foundation for its continued success</p>



<b>Country</b>	<b>Program</b>	<b>Program description including support structures</b>	<b>Likely reasons for success</b>
<b>Portugal</b>	Geology in summer	Programme run by the Ministry of Science and Technology. Students and citizens in general are the focus of the programme. Support structures are mainly related to Portuguese Universities.	Non-formal courses. Good scientific support
<b>Romania</b>	National Geographic Competition	This is a competition like the Olympic games (internal to our country and then international – the International Geography Olympiad).	
<b>Russia</b>	Summer geological school Geographic Competition different levels	Lecture about basic Earth science and field trips. Activities were conducted at local government office.	Unfortunately, to be professional in Earth science is not enough.
<b>South Africa</b>	Cradle of Humankind	Large thriving visitor centre dedicated to human origins. Programmes include: - Visitors to the centre - Talks and workshops for the public on weekends and in the evenings	Large government funded project, run commercially.
	Geological Museum at Museum Africa	Beautiful rock and mineral collection. Programmes include visitors to the museum (largely schools and teachers) with associated workshops.	Enthusiastic curator, with some support from community.
	National Museum Bloemfontein Palaeontology	Extensive palaeontology and geology exhibit. Kits of fossil casts to schools.	Well run museum with an enthusiastic head of palaeontology.
	Origins Centre- University of the Witwatersrand	Multi-media rock art exhibition. Schools and general public visit the museums. Some workshops in schools.	Initially good funding and support, enthusiastic person in control of education and outreach

Country	Program	Program description including support structures	Likely reasons for success
	Sci-Bono Science Centre	Earth Science Week, Sustainable energy week Invite presenters to exhibit and present workshops on the topic – reach about 5000 learners at a time	Substantial funding and support from the Provincial Education Department, well organised, dependent on quality of the exhibitors and participants
	University of Bloemfontein/ EarthWise	Not much known about it as coordinator very difficult to contact	-
	University of Kwa-Zulu Natal Science Centre	Visitors to the Science Centre, many workshops and programs	Enthusiastic person in charge, some funding support
	University of Witwatersrand Geosciences Outreach	Visitors to the museum, collections, offer specialized curriculum based workshops: palaeontology, human evolution, evolution theory, and hands on fossil kits	Enthusiastic people and perseverance
<b>Spain</b>	Bi-annual meetings' on Earth science teaching (organised by AEPECT)	Lectures, workshops, field trips, debates; lasting for 5 or 6 days; organised in co-operation with a local university.	Many Earth science teachers (usually geologists or biologists) find additional training useful for their classes. These meetings meet their needs.
	Jornadas sobre Didáctica de Biología y Geología	Lectures and workshops over two days. Bi-annual.	Reasonable prices.
	Summer geological trips	Organised by AEPECT. Very popular and successful.	Geological fun. Contact with local geologists.
	Geolodays	Urban field itineraries followed by local people.	Good organisation. Lots of fun. It allows people to re-discover their environment from another point of view.

<b>Country</b>	<b>Program</b>	<b>Program description including support structures</b>	<b>Likely reasons for success</b>
<b>Sri Lanka</b>	"Earth science for schools" teacher training workshops organised by Geological Society of Sri Lanka National Olympiad Competition for school students organised by Geological Society of Sri Lanka and the Dept. of Geology, University of Peradeniya .	Workshops include lectures and practical sessions	Teachers gather knowledge and collect materials for their lesson plans, while attending these workshops.
<b>United States</b>	Earth Science Week (2 <sup>nd</sup> week of October) sponsored by the American Geological Institute offers many groups suggestions and opportunities to promote the Geosciences. Many groups and organizations work at local and regional levels to promote geoscience with varying success.	The type of programme and support depends on the sponsoring organisation.	Varies with the type of programme.

## UNDERGRADUATE AND GRADUATE GEOSCIENCE EDUCATION

### Colleges/universities:

- How many offer undergraduate degrees in the geosciences or closely related fields?
- How many offer geoscience graduate (postgraduate) degrees?

Country	How many offer undergraduate degrees in the geosciences or closely related fields?	How many offer geoscience graduate (postgraduate) degrees?	Comments
Argentina	14	All of them offer MSc and PhD degrees and orientation courses	Geology is only taught at university level in public universities (no geology in private ones)
Australia	16 (source <a href="http://www.geodiscovery.com.au/links/aus_uni.htm">http://www.geodiscovery.com.au/links/aus_uni.htm</a> )	16	Some university geology schools have combined and others have closed in recent years
Bangladesh	<p>Geology, geography, soil science, environmental science, agricultural science have fully-fledged departments in university level education, and offer graduate and postgraduate degrees on these subjects.</p> <p>More than 80 students from the Departments of Geology, Geology and Mining, and Geoscience of three universities graduate per year. In the case of geography and others, these numbers are much greater.</p>	Mainly three universities and other universities offer postgraduate degrees in a number of subjects that are included in the discipline geoscience.	<p>Year of studies are given below: Undergraduate / Graduate Education</p> <p>i) Undergraduate education: College / University level of education - General Degree - BA / B.Sc./ B.Com - 2 years programme Honors degree - BA / B.Sc. / B.Com - 4 years program</p> <p>ii) Graduate Education: Masters Degree: 1-year program in case of BA./BSc./ B.Com Honors Degree 2 years programme in case of BA./BSc. General Degree and Doctoral Degree: 3 +</p>
Belgium			

Country	How many offer undergraduate degrees in the geosciences or closely related fields?	How many offer geoscience graduate (postgraduate) degrees?	Comments
<b>Brazil</b>	34 (in the last few years many new undergraduate programs in Geology have been created in the country as well as some new courses in Engineering Geology and Geophysics. Not to mention the Geography, Soil Science, Environmental Sciences, Agricultural Science subjects that also have fully-fledged departments in university level education.	There are 48 programs for graduate education in the country, including 11 that are restricted to the Masters degree and 37 that offer both the Masters and Doctoral Degrees:	Geology is mainly taught at university level in public universities, with just one exception for the last three decades, but in recent times new undergraduate courses of geology were introduced by private universities.
<b>Canada</b>	33	32	
<b>Czech Republic</b>	Not known		
<b>England</b>	20	20	
<b>Estonia</b>	Yes	Yes	
<b>France</b>	39	44	There are more than 75 universities in France. Most of them offer a diploma of 1st cycle (Licence) in Earth Sciences (graduation) and a big proportion a Master and a PhD course.
<b>Finland</b>	4	4 universities (Helsinki, Oulu, Turku and Åbo (Swedish Turku Uni)	Likely to become 3 in a few yrs (Helsinki, Oulu and Turku)
<b>Germany</b>	28	28	(source: Senatskommission für Geowissenschaftliche Gemeinschaftsforschung der Deutschen Forschungsgemeinschaft: Dynamische Erde – Zukunftsaufgaben der Geowissenschaften)
<b>India</b>	A few; exact number not known	Several postgraduate (Master) courses in different areas of geosciences	Geology is only taught at college and university level
<b>Israel</b>	3	3	
<b>Italy</b>	29	29	<a href="http://www.sienzegeologiche-italia.geo.unimib.it/index.html">http://www.sienzegeologiche-italia.geo.unimib.it/index.html</a>

Country	How many offer undergraduate degrees in the geosciences or closely related fields?	How many offer geoscience graduate (postgraduate) degrees?	Comments
<b>Indonesia</b>	6 University (state) 13 University (private) Total : 19 (State and Private), (Those which are accredited by the Ministry of Education).	4 (State)	Type of graduate degree: Master of Science or Master of Engineering.  The number of universities offering geoscience has been increasing in recent years. This is related to the increasing demands for geoscientists in Indonesia.
<b>Japan</b>	There are Earth science education departments in the colleges of education. Usually colleges/ universities have departments related to geoscience such as 'Astronomy, Atmospheric science, Oceanography, Geology', etc in the college of natural sciences and recently some have changed the name of their department to the Department for the Earth and Cosmic System. Some colleges/ universities also have geoscience-related departments in the college of engineering such as Earth/ environmental engineering, mineral resource engineering, etc.		
<b>Korea</b>	We only have an Earth science education department in the College of Education. Usually colleges/ universities have departments related to geoscience such as 'Astronomy, Atmospheric science, Oceanography, Geology, etc' in the college of natural sciences. Korean colleges/universities also have geoscience-related departments in the colleges of engineering such as Earth/ environmental engineering, mineral resource engineering, space engineering, shipbuilding engineering, etc. [please go to <a href="http://www.snu.ac.kr">www.snu.ac.kr</a> and look for 'engineering majors']. We just call this 'Earth science' in the college of education of universities. We have department of earth science education in around 10 universities in colleges of education. Other geology, astronomy, atmospheric science, and others belong to college of natural science or college of engineering. 'Earth science' itself belongs to college of education.		
<b>Malawi</b>	1	1	The university of Malawi has just introduced graduate geoscience studies
<b>New Zealand</b>	Yes at most Universities (7 in country) Unsure about Polytechnic institutes	5	Huge growth in post graduate geology at most Universities.
<b>Norway</b>	Approximately 9	9	Some are universities, some are university colleges
	COMMENT: The Norwegian universities offer Master Degrees in geoscience education (thus students can specialise in geoscience and teacher training in geoscience).		

Country	How many offer undergraduate degrees in the geosciences or closely related fields?	How many offer geoscience graduate (postgraduate) degrees?	Comments
<b>Philippines</b>	There are five institutions that offer a Bachelors degree in Geology in the Philippines. By next year, Bicol University will also offer a BSc Geology degree. A BSc Meteorology program has recently started this year (2012) by a consortium of five universities, including Bicol University.	University of the Philippines in Quezon City (Luzon) offers postgraduate (MSc/MA and PhD) programs in Geology, Meteorology, and Geography.	As a trend, the government is giving more emphasis to Earth Science-related courses. This is shown by the increase in number of scholarships offered by the government and other stakeholders, such as mining companies
<b>Portugal</b>	Yes	Several postgraduate (Master) courses in different areas of geosciences	
<b>Russia</b>	Geography in 83 universities Geology in 36 universities	Geography in 83 universities Geology in 36 universities	2100 -2500 graduates per year 40% to post graduate studies
<b>Romania</b>	Don't know		
<b>France</b>	3 year undergraduate degree	Master in geoscience	
<b>Saudi Arabia</b>	3	2	
<b>Scotland</b>	5, at Aberdeen, Edinburgh, Glasgow, Paisley and St Andrews universities	5, at Aberdeen, Edinburgh, Glasgow, Herriot-Watt and St Andrews universities	
<b>South Africa</b>	10	10	We do not have uniform standards for geology education from university to university - some universities produce graduates without the required maths making it difficult for graduates to get employment in industry
<b>Spain</b>	10 degrees and 7 mining engineering	All of them offer specific postgraduate programs, such as paleontology, etc.	Some of them are intercollegiates
<b>Sri Lanka</b>	5	2	Both universities offer MScs, MPhils and PhDs in fields related to earth science
<b>Taiwan</b>	30	10	Degrees in: astronomy, meteorology, oceanography, geology, Earth science Bachelor of Science

Country	How many offer undergraduate degrees in the geosciences or closely related fields?	How many offer geoscience graduate (postgraduate) degrees?	Comments
Trinidad & Tobago	1	0	Only two universities in Trinidad. A Petroleum Geoscience degree and a Geography degree at UWI in Trinidad
United States	<a href="http://geology.com/colleges.htm">http://geology.com/colleges.htm</a> lists more than 600 institutions that "have geology programs, grant geology degrees, or offer geology courses" in the United States, but not all of the schools offer degrees.	<a href="http://www.gradschools.com/search-programs/geology">http://www.gradschools.com/search-programs/geology</a> lists 190 programs that offer Doctorate degrees and 336 programs that offer a master's degree in earth science, geology and environmental science.	
Uruguay	130 Geography 146 Geology	32 geography 67 geology	

#### Summary of undergraduate and graduate geoscience education data

Country	How many offer undergraduate degrees in the geosciences or closely related fields?	How many offer geoscience graduate (postgraduate) degrees?
28 countries	Range from 1 to perhaps 600; where definite figures are available, mean of 14	Range from 1 to 336; where definite figures are available (excluding US), mean of 13



**Additional Comments**

Country	Do college and university geoscience departments actively mentor teachers in the pre-college school systems?	What do you see as the major problems facing geoscience education in your country?
<b>Argentina</b>	Not yet, but this is supposed to change in the near future because the educational law says that teachers should participate in research teams at the university (Do you know who is going to give us the money to do so...?)	
<b>Australia</b>		<p>Earth Science curriculum in Australia – 2013 comment                      The Australian Curriculum currently being implemented contains four sub-strands in the ‘Science Understanding’ strand – Biological, Chemical, Physical and Earth and Space Science. This essentially means that Earth Science has an equal ‘share’ in the curriculum to the other sciences from Foundation to Year 10. In a number of instances, there are links with the other sciences that help to explain concepts in the Earth and Space Science sub-strand. The other two strands, Science as a Human Endeavour and Science Inquiry Skills allow student to explore issues and undertake Scientific Inquiry around Earth Science topics.</p> <p>The foundation content sub-strand begins with daily and seasonal changes, leading on to students describing observable changes and patterns in the sky and local landscape. Earth resources and their uses are introduced in Year 2 with surface processes caused by natural and human means developed in Year 4. In Year 5 planetary systems are introduced with geological change and extreme weather patterns included in Year 6. The Year 7 sub-strand covers a range of concepts including eclipses, renewable and non-renewable resources and water as a resource that cycles through the environment. The Physical Science sub-strand addresses gravity and motion which links with the Earth Science topics. Year 8 sees the Rock Cycle and geological time introduced, with plate tectonics the focus in Year 9. Year 10 requires the Big Bang theory to be used to explain the origins of the universe and a study of different features the make up the universe, such as galaxies, stars and solar systems. Global cycles are also a focus and their reliance on interactions involving the lithosphere, atmosphere, hydrosphere and biosphere. Natural selection and evolution are topics in the Year 10 Biological Science sub-strand and link well with the Earth Science topics developing an Earth System approach.</p> <p>This Science curriculum is required to be taught across Foundation to Year 10 in all Australian schools by 2014. Professional organisations are providing considerable professional development to teachers to assist with the implementation. Australia’s economy being dependent on the mining sector has probably helped to promote Earth Science! Science is a compulsory subject up until the end of Year 10. After this, students can take up Earth and Environmental Science or Geology as a senior secondary subject.</p>

Country	Do college and university geoscience departments actively mentor teachers in the pre-college school systems?	What do you see as the major problems facing geoscience education in your country?
<b>Bangladesh</b>	No, there are no such activities in Bangladesh.	<p>Lack of proper education for students to realise the importance of geoscience education and lack of initiative from concerned people i.e., geoscientific community are the major problems. Moreover, low literacy rates and economic conditions are also problems facing geoscience education in our country.</p> <p>In the next three years, we expect that we will be able to convince our concerned Ministry to introduce geoscience curricula into the syllabuses of pre-college and college level of education. We have also a plan to organise workshops on geoscience education for students and teachers at schools and colleges, to give them some idea about how important geoscience education is for ourselves and our society. We hope geoscience will become more popular in the next few years in Bangladesh.</p> <p>We will try to contact international organisations which focus on geoscience education goals and are very active in this field, for their kind suggestions and advice. For example, the Australian Geological Survey Organization and some other organizations in UK and USA are very active in this respect - and they can help us by providing valuable suggestions by attending workshops/ seminars on geoscience education whenever we arrange such an events in Bangladesh in future. Being a developing country, it may not be possible for us to provide financial support to them to come to Bangladesh. Organizing seminars / symposia etc are the best way to popularise geoscience and geoscience education and their importance to human life and society. But, in organising these types of events, our financial situation is one of the major obstacles.</p>
<b>Brazil</b>	No, in general terms they seem of not being dedicated to this task. In the Geosciences Institute of the State University of Campinas, the Department of Geosciences Applied to Teaching has offered programmes in master and doctorate degrees for graduate personal. The aims of the courses are strictly dedicated to research in geoscience education for teachers at all school levels. Some training activities for "in-service" teachers have been given more and more incentives in Brazil. There is not a nationwide training program for basic school teachers, but some states, as the São Paulo State, have provided training programs, using a technical support from the state universities USP, UNESP and UNICAMP.	

<b>Canada</b>	The University of Victoria School of Earth and Ocean Sciences offers a lab section specifically for pre-service teachers in its first year Earth science course EOS 120, and also hosts workshops for preservice teachers in the Faculty of Education	Earth science is not a teachable subject in most provinces/territories so few teachers specialize or focus in Earth science. Most, especially at the Elementary and Middle School level, have little background and few resources and are often intimidated by Earth science curriculum topics. The challenge is to empower teachers so they can enthusiastically engage their students in hands-on, relevant and student-centred Earth science learning. CGEN through EdGEO offers teacher workshops (~ 10-12 per year) which provide mentoring, practice, lesson-plan ideas, resources and local knowledge for hundreds of teachers each year.
<b>Czech Republic</b>		The future is, that there will be new curricula after the year 2007-8 – all natural sciences will be taken into one subject area called “Human and Nature”.
<b>England</b>	No	
<b>Estonia</b>		Estonia participated in TIMSS 2003. <a href="http://nces.ed.gov/timss/TIMSS03Tables.asp?Quest=3andFigure=6">http://nces.ed.gov/timss/TIMSS03Tables.asp?Quest=3andFigure=6</a> The Trends in International Mathematics and Science Study (TIMSS) 2003 is the third comparison of mathematics and science achievement carried out since 1995 by the International Association for the Evaluation of Educational Achievement (IEA), an international organisation of national research institutions and governmental research agencies. In 2003, some 46 countries participated in TIMSS, at either the fourth- or eighth-grade level, or both. <b>In geography Estonian students were the best in the world!!!</b>
<b>Finland</b>	Yes, through Geo-site at the Helsinki University	The number of students taking the geography courses in high school is declining. More active promotion of Geology and Geosciences is urgently needed.
<b>Germany</b>	Only geography departments are involved in qualifying future teachers.	<ul style="list-style-type: none"> <li>• The geography curricula emphasise anthropogeography.</li> <li>• The curricula of biology, physics and chemistry barely focus on geoscience topics.</li> <li>• Many geography teachers do not have a sound science education.</li> <li>• The tradition of teaching geoscience topics in geography: very descriptive, quite idiographic, less process-oriented, less connected to biology/ chemistry/ physics.</li> </ul>
<b>India</b>	No, there are no such formal activities in India.	<ul style="list-style-type: none"> <li>• Geoscience marketing is important because the scientific community doesn't realize the applications of geoscience.</li> <li>• Geoscience careers should be made attractive so that the best talent can be attracted. Massive Funding is required to promote the subject.</li> </ul> <p>In future, it is visualized that a standard curriculum integrating physics, chemistry, biology, and Earth science will be required and has to be done.</p>

Country	Do college and university geoscience departments actively mentor teachers in the pre-college school systems?	What do you see as the major problems facing geoscience education in your country?
Indonesia	<p>There is no requirement for geoscience departments to mentor teachers in pre-college education. The reason is that the Indonesian Government Education Policy does not permit the introduction of any subjects outside pre-college curriculum standards.</p>	<p>To provide the baseline standards, the Government has established standard curricula for whole school levels. However, many parents and teachers consider that such curricula are too ambiguous. Too many subjects should be learned by students, so that there is less and less chance for them to have time for improving their creativity.</p> <p>The curricula have been changed or modified several times. Attention to improving the method of teaching and student creativity seems to have been overlooked in each curriculum modification. Lack of teachers who can manage all subjects and lack of educational funding exacerbate the education problems. We found the following deficiencies especially in geography:</p> <ol style="list-style-type: none"> <li>1. Topics are introduced too early and in too much detail in the elementary school (Year four elementary school). Too much detailed information (but without real examples) make it difficult for pupils to understand.</li> <li>2. Some information concerning rock formation and rock classification are not correctly introduced to students. There are some mistakes in the knowledge provided.</li> <li>3. Lack of real and attractive examples, such as rock samples, slides, CDs, videos, field visits, make this subject un-interesting and rather difficult to understand.</li> <li>4. Lack of available funds.</li> <li>5. All of the above deficiencies result in poor knowledge, poor understanding and poor appreciation by the public, of geoscience. Consequently, when there are any problems concerned with geological hazards, such as landslides, floods, earthquakes, volcanic eruptions, it is hard to warn and protect the public.</li> </ol> <p>At the college level, usually the theses (Final Project Reports) of students in industry do not create value to the company. On the other hand, the companies expect university graduates to be ready to work directly in the company without necessary additional training. In contrast, the aim of university education is not to prepare students with the skills that could be readily applied in industry, but developing the knowledge and understanding of graduates for the nation's future prosperity instead.</p> <p>Some other remarks are:</p> <ul style="list-style-type: none"> <li>• Geoscience marketing is important because the community doesn't realise what geoscience is.</li> <li>• Geoscience knowledge should be taught earlier in schools, beside the applied technology science.</li> <li>• Educate the lecturers in the Universities and government officials on how to transfer geoscientific knowledge to the entire community.</li> <li>• Funds are needed for improving geoscience education for the community.</li> </ul>

Country	Do college and university geoscience departments actively mentor teachers in the pre-college school systems?	What do you see as the major problems facing geoscience education in your country?
Israel		<p>Although there have been great efforts and successes with students and teachers, the implementation of Earth science education in Israel is still limited. The main reason for that is the science education establishment. This establishment is influenced strongly by committees of scientists, who actually decide what will be taught in practice in schools. Unfortunately, those committees are composed of scientists from physics, chemistry and biology. No Earth scientist takes part in these committees firstly because the leaders of these committees don't allow this to happen and secondly because of the Earth scientists don't fight strongly enough to be included.</p> <p>As a result, whenever we succeed in raising our profile in schools, these committees respond with new decisions that make teachers to stop teaching Earth science.</p>
Korea		<p>Sometimes I am thinking of "geo" term. Geo means 'earth' or 'geography' or 'soil' according to the context which 'geo' term is used. Geoscience means 'earth' science. It will be better to define 'geo' operationally in the manner of extended one. There are activities by those active in physics education, chemistry education, and biology education, but not Earth science or geo education. I hope representatives of each country related to geoscience education field will take on a role of improving and innovating international geoscience education more actively than now. IGEO is very slow in its improvement.</p> <p>We developed and innovated the Earth science curriculum in 2009 by the integration of other areas. I hope to have the chance for geoscience educators to share the ideas to decide which areas should be part of the compulsory curriculum and which can be 'differentiated' regularly through symposia or conferences.</p>
Malawi		<p>Among the major challenges in Malawi's geoscience education programs is the lack of resources, such as student access to computing facilities, lack of resources for student industrial attachments during vacations, students final year dissertation research and field schools during vacations. This may be affecting quality of the graduates, despite the fact that these would have adequately mastered the theoretical aspects of the subject.</p> <p>Another major challenge is that students are not adequately exposed to Earth science at an early stage. Earth science as a subject is offered at undergraduate level. This unawareness has led to the students thinking that geography is just the same as Earth science. The shortage of Earth scientists in Malawi is obvious.</p>

Country	Do college and university geoscience departments actively mentor teachers in the pre-college school systems?	What do you see as the major problems facing geoscience education in your country?
New Zealand		<p>Earth science continues to be a major issue in curriculum design. New Zealand is just beginning a review of the national science curriculum in which Earth science makes up the fourth strand. There have been many battles in keeping Earth science in the curriculum and it survives as Planet Earth and Beyond (astronomy). The review is looking at key achievement objectives. The links between Earth science and geography and environmentalism have always been contentious and are likely to increase in difficulty as traditional academic subjects struggle to compete with newer subjects for a space in the already overcrowded curriculum.</p> <p>A key issue is teacher training and the role teacher training establishments play in this. There is no independent Earth science department dedicated to training the teaching of Earth science. Indeed, the lack of teacher expertise in Earth science is a major concern, as is a lack of resources and funding. There are major concerns regarding a decline in the number of students (13% since 2001) presenting for the external examination at year 11 (age 15), and the low number of schools (about 50) offering Earth science as a national science curriculum strand.</p> <p>Resources tend to be uncoordinated and at the mercy of individual enthusiasm rather than part of an integral and vital part of student learning and teacher training. My own current PhD research into conceptual change within the Earth sciences is an attempt to address issues of what and how Earth science teaching and learning might more efficiently happen. For example there is little point in having curriculum achievement objectives that are beyond (or prior) to student conceptual status. Current research suggests that teachers at primary and secondary level are conceptually barely removed from the conceptual status of the students they teach!</p> <p>There is a need for funding to establish a dedicated Earth science teacher training facility. This should be taken on board by Colleges of Education but it is not. The reasons are historical, educational and political.</p> <p>The 2007 science curriculum has removed rocks, fossils, minerals, Earth history and stratigraphy to focus on Earth's interacting systems. Year 11 (age 15 years) there is emphasis on the internal and external processes controlling surface features. There is less 'nuts and bolts' material and a greater emphasis on human interaction with Earth's systems especially at final year high school science. There is larger overlap with geography (such as natural hazards).</p> <p>There is less focus on inquiry and laboratory investigation for geoscience. Fieldwork has been almost nonexistent for some time.</p>

Country	Do college and university geoscience departments actively mentor teachers in the pre-college school systems?	What do you see as the major problems facing geoscience education in your country?
		<p><b>External examination for geoscience has now been removed from Year 11 Science.</b> Very few students nationally engage with geoscience after year 11 (and numbers continue to decline at year 11).</p> <p>Astronomy remains an area of concern and difficulty but is still coupled with the Planet Earth and beyond strand.</p>
<b>Norway</b>		<p>Through the Geo programme initiated in 2008, we now know more about geoscience education at upper secondary level. The programme has enabled us (at the Norway Center for Science Education) to talk with and listen to geoscience teachers and students. We have observed many classroom lessons: the students choose the optional geoscience course because it is interesting and relevant for their understanding of the news, e.g. earthquakes and extreme weather. The number of students choosing the optional subject is steadily increasing every year.</p> <p>The Norway Center for Science Education has also been contacted by Sweden in order for them to learn about Norwegian geoscience education. We are also in contact with Denmark – they are trying to establish a new geoscience subject in upper secondary school following the same 'model' we have here in Norway. The Danish are coming to Norway later in June to learn about the Geoprogramme lead by Merethe. Hopefully, you may include Denmark in your database very soon.</p>
<b>Philippines</b>	No, this is very rare if they exist at all.	<ol style="list-style-type: none"> <li>1. Because of the K+12 curriculum, we need more educational resources to address the requirements of the curriculum</li> <li>2. Also because of the K+12, the Teacher Education institutions need restructuring. Specialisations must now include Earth science, among others. But the problem will be the “experts’ who will teach the Earth science subjects.</li> </ol>
<b>Russia</b>		<p>Russian President Vladimir Putin October 18, 2007 signed a decree "On holding in the Russian Federation in 2008 the International Year of Planet Earth" № 1380. In response to this Presidential Decree Prime Minister Zubkov signed the order of the Government of the Russian Federation December 24, 2007 № 1897-r of the formation of the National Committee for the Russian Federation in 2008 the International Year of Planet Earth, which are required to develop and approve the outline plan by holding it to provide that activities in the field of natural resource management and environmental protection, science, education and culture. National Committee for the International Year of Russia in the Earth led the Minister of Education and Science, AA Fursenko.</p> <p>To provide the baseline standards the Government has established standard curricula for the whole school levels. “Introduction to the geology” - of the standard today in geography subject in school. However, geology in the standard of geography doesn't have enough teaching time.</p>

Country	Do college and university geoscience departments actively mentor teachers in the pre-college school systems?	What do you see as the major problems facing geoscience education in your country?
<b>Scotland</b>	No	
<b>South Africa</b>	No	<ul style="list-style-type: none"> <li>• Geosciences is unlikely to ever be taught as a main subject as there are simply too many competing well-established subjects</li> <li>• Teacher training is required to strengthen the geoscience component of the subjects they are already teaching</li> <li>• Museums out of school informal learning centres need assistance in developing high quality and assessed curriculum related earth science programmes to support teaching in schools</li> <li>• Continued interaction with committees responsible for drafting curriculum statements is required so that the curriculum contains (in whatever subject) the essential knowledge of geosciences required by every citizen.</li> <li>• [Internationally it would help if there could be agreement amongst geoscience educators about what this knowledge is]</li> <li>• At tertiary level we have difficulty attracting good students into geoscience-related fields – good students study medicine, commerce, engineering etc. etc. Weaker students want to do geology because of the prospects of jobs in the mineral industry</li> <li>• At tertiary level we have a problem of retiring academics with few candidates to replace them. Good postgraduates are attracted into industry or to study overseas.</li> <li>• With regard to teacher training – few geologists with the job prospects of the mineral industry enter into secondary education or into teacher training – teacher trainers therefore have primary training in one or another of science disciplines (biology or physical sciences).</li> </ul>
<b>Sri Lanka</b>		The main problems in promoting geoscience education in Sri Lanka are: geoscience is not taught as a main subject in school curriculum, lack of awareness of geoscience among school students, lack of awareness about geoscience-related job opportunities, shortage of Earth science learning materials in schools, etc.
<b>Taiwan</b>	All the university geoscience departments have more or less duties to do this. But National Taiwan Normal University is mainly in charge of mentoring teachers in secondary school systems. Geoscience education has declining status and less emphasis throughout the curriculum.	What changes do you expect to see in the next three years? An integrated curriculum standard including physics, chemistry, biology, and Earth science.
<b>Trinidad &amp; Tobago</b>		At the end of the primary level, at about age 11, students are required to sit a highly competitive secondary school entrance exam. Performance on this high-stakes exam is used to place students into preferred secondary schools. The exam only tests math and language skills and as such many schools opt to teach little or no social studies and science in the two years preceding this exam.



