Trends Shaping Education 2014 Spotlight 4

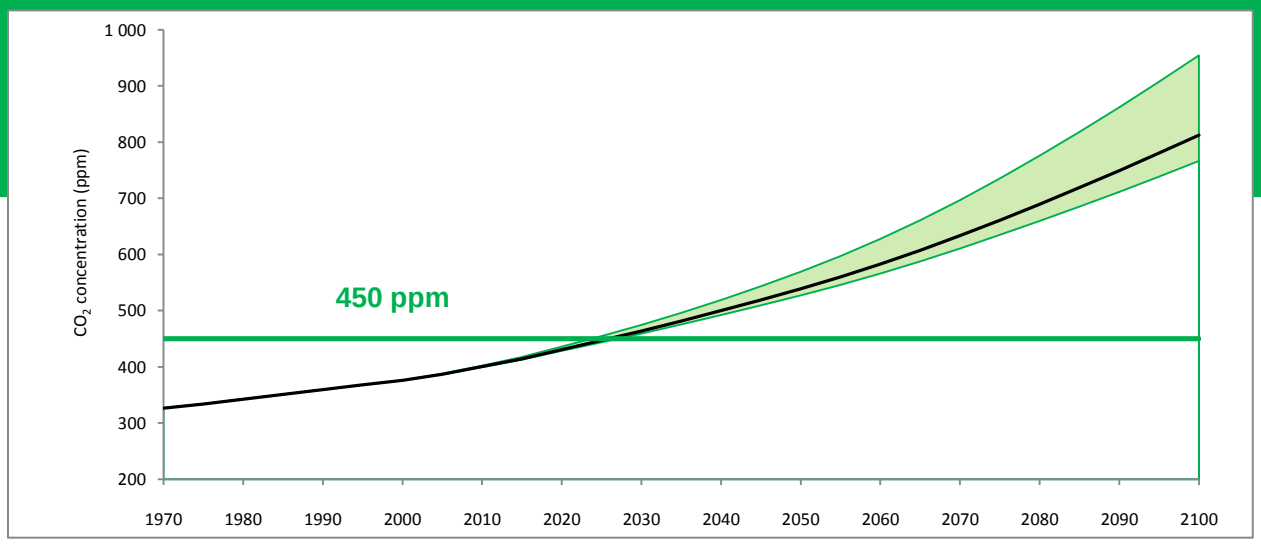
Think Green

The environment is a hot topic in the press and classrooms and much has been said about the need for action to protect our planet. Education plays a crucial role in raising awareness of environmental challenges and shaping the attitudes and behaviours that can make a difference.

Our natural world at risk

Scientists are concerned about changes in climate that alter the composition of the global atmosphere which can be attributed directly or indirectly to human activity (UNFCC, 2014). If current trends continue, the concentration of Green House Gases (GHGs) in the atmosphere would reach 685 parts per million (ppm) by 2050 (see Figure 1). This would be far above the 450 ppm threshold established by the 2010 United Nations Framework Convention on Climate Change and would lead to a global average temperature increase between 3 and 6 degrees Celsius (OECD, 2013).

Figure 1: Long-run CO2 concentrations and temperature increase: Baseline, 1970-2100



StatLink http://dx.doi.org/10.1787/888932570544

Notes: Uncertainty range (green shading) is based on calculations of the MAGICC-5.3 model as reported by van Vuuren et al., 2008 as cited in (OECD, 2012d).
Source: OECD Environmental Outlook to 2050.

Such a large temperature increase would lead to water shortages for billions of people, reduce agricultural yields, increase malnutrition related deaths by millions and lead to the extinction of a large part of animal species (Stern, 2007). These devastating effects on the natural environment, and the insecurity they create, could lead to conflict and political instability, particularly in the developing world.

Doing nothing to combat climate change and continuing with "business as usual" is not an option.

Given these catastrophic predictions, why have efforts to tackle climate change not been more effective? Firstly, even though OECD countries have a lot of the human and physical capital needed to mitigate climate change, they are the least affected by it. Many of the extreme effects of climate change (for example, rising sea levels, weather related disasters and water shortages) will occur in non-OECD countries, both because of geographical location and less sound infrastructure in lower income areas (Stern, 2007). Secondly, climate change will most strongly affect future, rather than present generations. Lastly, climate change is a supranational problem and cannot be solved by states individually. To reduce global GHG emissions, countries need to act collectively in such a way that everyone consumes resources more sustainably. Regrettably, this gives each country an incentive to "wait and see" rather than acting swiftly to reduce their own emissions.

All of these factors make climate change, and indeed other environmental issues such as decreasing biodiversity, air and water pollution and increases in natural disasters difficult to tackle. Citizens in OECD countries are faced with the tough choice between the immediate benefits of economic growth and the possibility of future disaster. They must find a way to work together in order to address environmental issues. Education can play a key role in this process.

Thinking green in schools

In order to mitigate and adapt to climate change, environmental awareness needs to be built in schools from the start. Numerous OECD countries have already incorporated environmental topics into their curricula and look at issues like recycling, daily consumption habits and sustainable behaviours (UNESCO/UNEP, 2011).

PISA 2006 was the last PISA round to look specifically at science issues. On average across all participating countries, only 19% of students performed at the highest level of proficiency (see Figure 2). Exceptions included Canada, Finland and Japan where more than 30% of students did (OECD, 2009). Students at

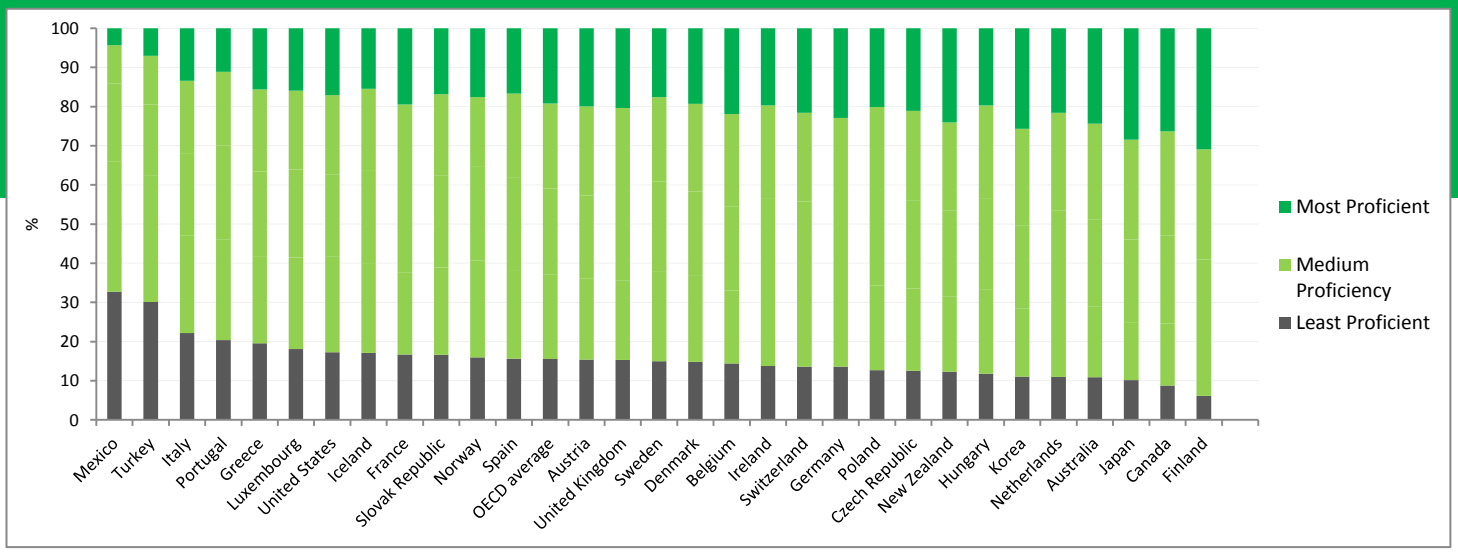
The Nature School Movement in the USA

The Durmlin Farm Community Preschool in Lincoln (Massachusetts) takes a very hands-on approach to teaching young children about the environment. Lessons take place outside, in a working farm and a wildlife sanctuary. The three to five year old children are given the opportunity to learn about the natural world directly by participating in farm chores, taking part in planting activities and simply exploring the woods and fields that surround them. This kind of nature-based education promotes a sense of environmental awareness in very young children and helps them understand the interdependent relationships between the human and the natural world.

More information:
http://www.bostonglobe.com/magazine/2013/10/05/nature-preschools-and-kindergartens-getting-kids-moving-and-learning/Vmy0nPeCoeVhxV4xzncPAO/story.html

this proficiency level were aware of environmental issues and understood their complexity, which suggests that they have an adequate understanding of the challenge that climate change presents.

Figure 2: Percentage of students by proficiency level in the environmental science performance index



StatLink http://dx.doi.org/10.1787/562200685357

Note: Level A is marked as "most proficient", Level B-D are collapsed in the "medium proficiency" category and below Level D is "least proficient".
Source: OECD PISA 2006 Database, Table A2.1, modified to include only OECD countries.

In contrast, 16% of students perform at the lowest proficiency level on average and in countries like Italy, Mexico and Turkey more than 20% of students rank at this level. These students were unable to answer questions about basic environmental phenomena. Students with low levels of proficiency were much more likely to be overly optimistic about environmental issues and also much less aware of the dramatic consequences of inaction.

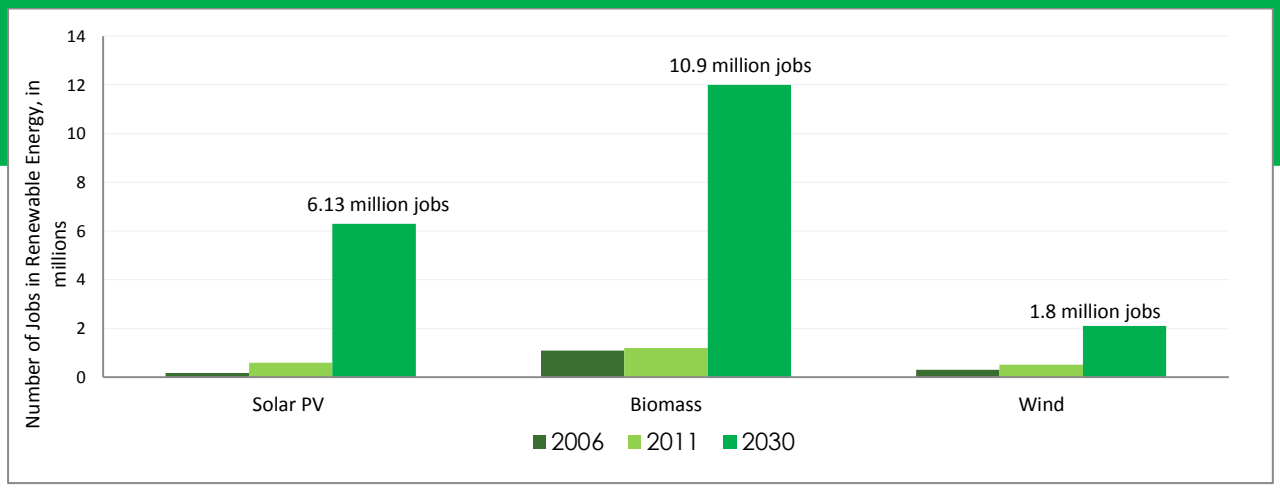
The performance of students in environmental science is closely related to performance in traditional science courses (such as physics, biology and chemistry) (OECD, 2008). This finding suggests that students are able to use their general knowledge about science and apply it to environmental issues. Better science education in general can thus be combined with specialised courses in order to increase student proficiency in environmental science. The next cycle of PISA (in 2015) will again focus on science issues and will be an opportunity to verify which countries have taken the lead on the topic and which are falling behind.

Education and green skills

A major component of transitioning to a low carbon economy in which resources are used sustainably is the development of what can be called 'green skills'. Green skills are the abilities, values and attitudes people need to build and support a sustainable and resource-efficient society (Cedefop, 2012).

In a resource efficient economy, skill demands will include new types of expertise for emerging labour needs. For example, the ILO (2013) estimates that in 2030 about 20 million jobs will be created in the renewable energy sector. As shown in Figure 2, half of these jobs would be in the biomass sector and about 6 million would be in the solar energy sector. Our education systems (at both secondary and tertiary levels) need to prepare graduates with the skills required by these and other emerging markets.

Figure 3: High Demand for Green Skills – Forecasted Employment in Renewable Energy in 2030



Source: For 2006 and 2030 data – ILO (2008), Green Jobs: Facts and Figures. For 2011 – ILO (2013), Skills and Occupational Needs in Renewable Energy.

However, responding to the demand for green skills does not necessarily mean reinventing careers. It also means creating and training a workforce to be flexible and adaptable to changing standards and requirements. In the construction industry for example, the focus is on equipping workers with the skills needed to comply with changing standards in building codes as more builders (and cities) go green. Vocational education and training systems will play a key role in meeting these needs, and must make sure to provide relevant and timely opportunities for students (Cedefop & ILO, 2010).

Already today, countries struggle to provide workers with the right skill set. For example, German and Spanish authorities have already signalled a lack in skilled photovoltaic workers to install and maintain solar electrical systems (OECD, 2012a/b). Such skill shortages are a major impediment to the growth in these green industries. They also make the move to a green economy slower and more expensive than it could be.

Green skills are not just technical but also include other abilities like sustainable management and consumption practices.

For education systems this means that students need to be provided with the relevant technical skills, flexible general skills, a strong foundation in science and mathematics, and with the environmental awareness that motivates them to work in green jobs. Policy measures such as work-based learning and the provision of better career guidance can be powerful tools to strengthen the

link between skills development and the economic agenda of countries, including the move towards a greener economy.

Importantly, the transition to a low carbon economy will change skill demands very unevenly, as was the case with the ICT revolution (OECD/Cedefop 2014). Even though everyone needs to be able to adapt to greener technologies and consume responsibly, skill demands for some occupations will change very little. For example, even though a bus driver might drive an ecologically friendly bus, this will not really affect the skills s/he needs on a daily basis.

Moving to a green economy will not only create new occupations but will also make others redundant. Many people who now work in industries like mining and agriculture will need to be re-trained (OECD, 2012c).

The development of green skills is not only reactive but is also a driver of change (Bowen et al. 2009). Education is thus also about changing behaviours and reinforcing the skills that are needed to live in and create resource-efficient communities.

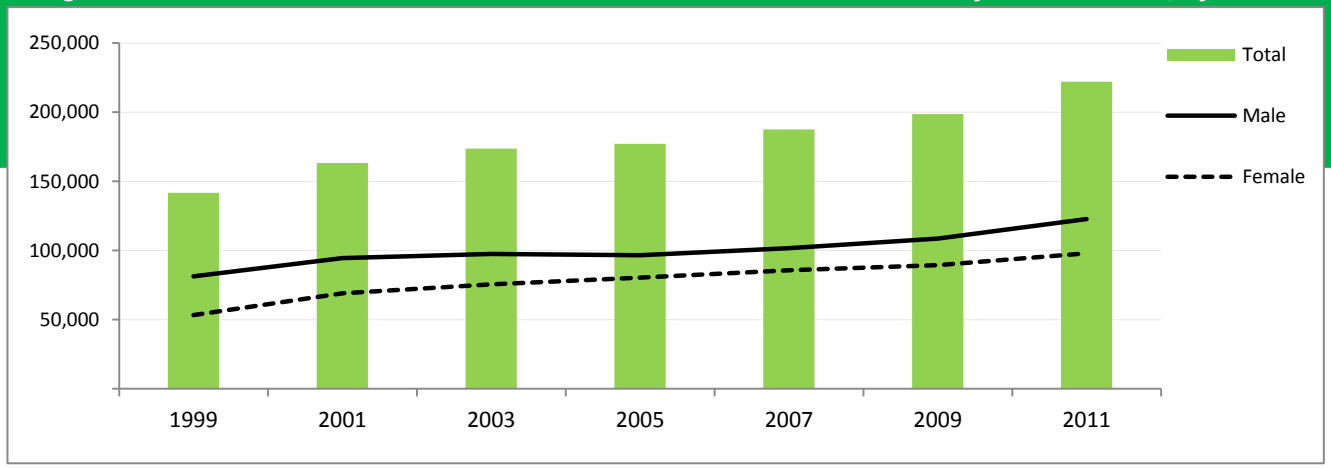
A challenge for higher education

Green graduates

Universities are in a unique position to contribute to the mitigation of climate change (OECD, 2011a). They can generate human capital on environmental issues in their region, act as a source of expertise, inspire through good practice on campus and add to existing knowledge through research (Mora et al., 2006).

Figure 4 shows the number of OECD graduates in environmental protection (e.g., conservation, pollution control) and physical sciences (e.g., climatic research, meteorology, atmospheric research).

Figure 4: Number of OECD Graduates in Environmental Protection and Physical sciences, by Gender



Note: Excluding Greece, Iceland, Japan and Luxembourg. Physical sciences includes some degrees that may not be directly related to the environment, other degrees (for example, environmental engineering) are not included due to the broad scope of the categories. More specific data are not available.
Source: OECD (2011), OECD. Stat, (database). Available at: http://stats.oecd.org/Index.aspx?DatasetCode=RGRADSTY#

In 2011, 60% of all graduates in environmental protection and physical sciences graduated from universities in France, Germany, Korea, the UK and the USA.

In 2011, 220,000 students received university degrees in these subjects across the OECD. This constitutes a 62% increase in "green graduates" since 1998, which is comparable to growth rates in fields like mathematics and statistics. Notably, the majority of graduates in these two fields are male. In 2011 around 122 thousand men and 98 thousand women completed higher education in environmental protection and physical sciences. Even though this is a sizable difference, it is much smaller than in areas like engineering, mathematics or computer science, where only around 20% of graduates are female (OECD, 2011b). This gender gap has narrowed in the past ten years as more women complete tertiary education in subjects that are directly relevant for green innovation.

As with green skills, universities need to maintain strong links to employers and research institutes in market areas related to these areas of study (OECD/Cedefop, 2014). This will help ensure that students have a robust background in the most relevant technologies and can adapt to changing market conditions in a timely manner.

Green innovation

Innovation can generate processes that help us use natural resources more sustainably, develop products that solve difficult technological challenges, and even create new organisational models to improve environmental efficiency. It is therefore pivotal in transitioning to a green economy.

The number of patents awarded for environmental technologies gives an indication of activity levels in green innovation. Environmental patenting showed a clear upward trend for all OECD countries between 1999 and 2008 (OECD, 2012d), as the market for green innovation grew and became more dynamic. In 2011, most patents in this category focused on energy generation from renewable sources, emission abatement and fuel efficiency in transport.

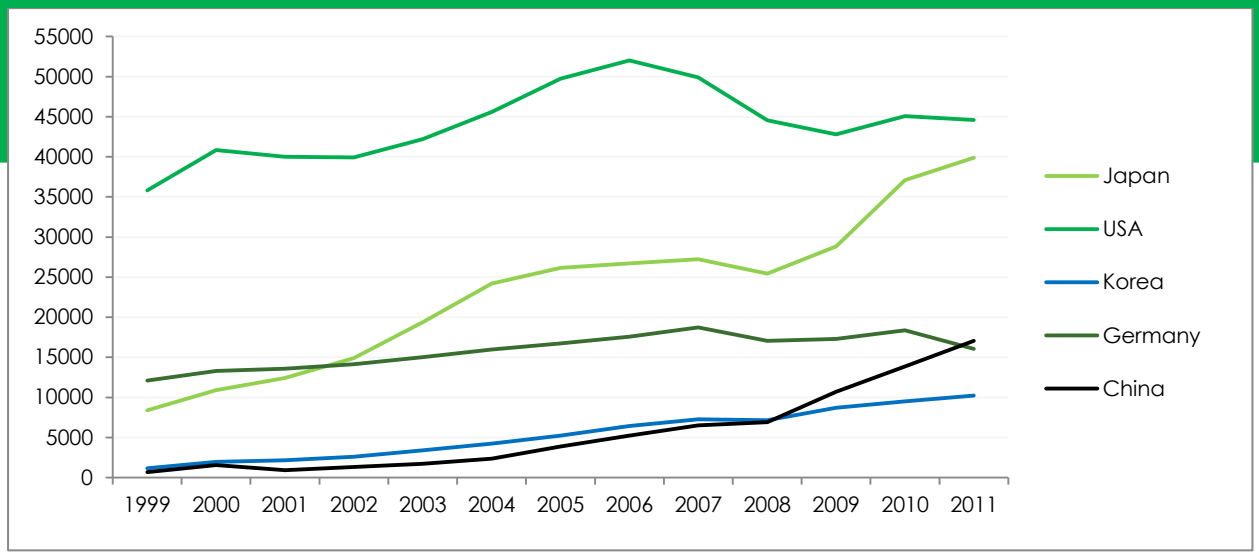
As shown in Figure 5, Japan and the USA are market leaders in green innovation, when measured in the number of patents. Germany and Korea also play an important role. Once the total number of patents is adjusted for GDP per capita, smaller OECD economies like Denmark, the Netherlands and Switzerland also show high levels of patenting per unit of GDP. These economies might be able to gain leadership in specific green technology niches (OECD, 2012d).

Denmark's Cleantech Cluster

The Copenhagen Cleantech Cluster (CCC) takes an innovative approach to solving global environmental challenges through local innovation. Green innovation requires a complex combination of technologies and competencies. This is why the CCC relies on a new collaborative approach that brings together universities, business and public-sector actors. The high level of collaboration in the CCC ensures that green innovation is implemented and that actors can learn from one another and exchange ideas and skills.

More information:
http://www.cphcleantech.com/

Figure 5: Number of Patents for Environmental Technologies for Selected Countries



Source: OECD (2011), OECD. Stat, (database). Available at: http://stats.oecd.org/index.aspx?queryid=29068.

Countries outside of the OECD are also investing in green innovation. China has increased the number of registered patents in environmental technologies by more than 2500% between 1999 and 2011. By 2011, China registered more green patents than Germany, and this number is expected to continue to grow.

This is not random: China has joined Australia, Brazil, Canada, Japan, Korea, Israel, the United Kingdom and the USA in prioritising green innovation. In 2012 the State Intellectual Property Office (SIPO) of China launched a prioritized examination programme for patent applications directed at several categories of green technologies. These include energy saving and environmental protection inventions, new energy technologies, new energy vehicles, as well as low-carbon and resource-saving technologies helpful for green development.

The challenge of teaching sustainability at work and in schools

Lifelong learning

Most of today's adults grew up and went to school in a world where climate change was not as pressing an issue as it is today. Hence, it is very important to build on the foundational skills of adults and include them in public awareness, information and career guidance programs. In order for this to be feasible, policymakers need to ensure that education and training is continuous through life and flexible enough to be accessible to adults.

The management literature makes some concrete recommendations for how to improve environmental

education programmes (Hopkinson and Dixon, 1998). They suggest that training should address groups that are as homogenous as possible, that providers should establish clear objectives for what participants should learn and most importantly, that training for green skills should be integrated into wider training and skill development policy rather than being seen as additional and separate from other skills (OECD, 2005).

However, training the OECD's adult population on environmental issues is not a simple task and faces two main obstacles. Firstly, two-thirds of the OECD's labour force work in Small and Medium Sized Enterprises (SMEs) which frequently do not have the resources for training and may have limited awareness of environmental issues (OECD/Cedefop, 2014). Hence, governments will need to invest time and resources in training staff at SMEs. Secondly, there is already a shortage in training providers with sufficient environmental awareness and expertise in low-carbon technologies (Szovics et al., 2009).

This shortage will drive up the cost of training and will slow down the transition to a low carbon economy if it cannot be filled within a reasonable timeframe.

Rethinking the way we learn

Even though it is important that students are aware of the scientific processes that cause climate change, raising awareness will not be enough. Climate change is a global challenge that will strongly affect present as well as future generations and requires students to understand the science as well as be willing to trade off immediate for long term gains. This means that education systems need to create critical thinkers that are able to connect their daily decisions to long-term consequences not just for themselves but for society as a whole.

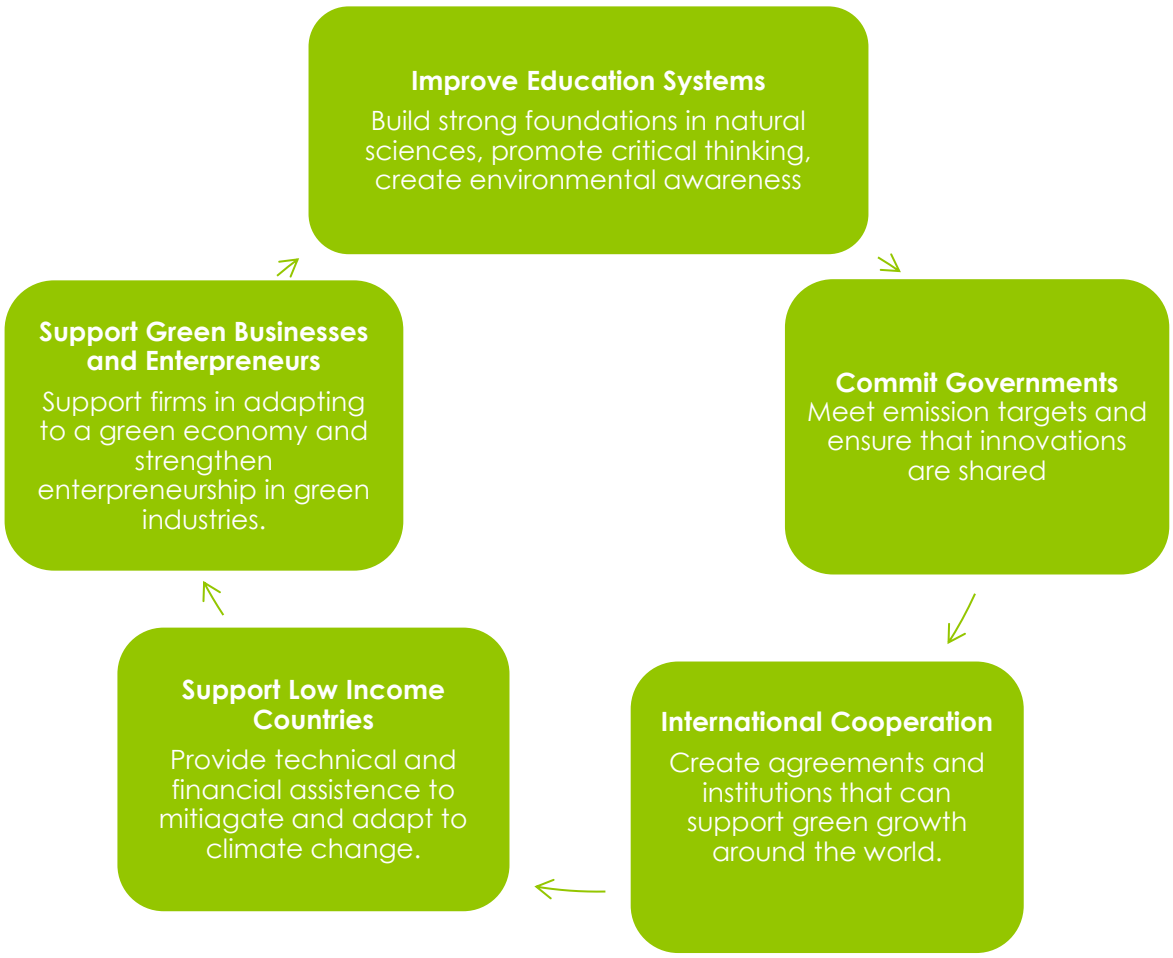
Stevenson (2007) notes two fundamental ways in which many of today's school systems would need to adapt in order to provide students with these skills. Firstly, he notes that the majority of school systems portray individual academic achievement as the main goal and convey norms of individualism, independence and competition. However, environmental challenges affect all human and non-human species and might never strongly affect some students individually.

Secondly, students would need to engage with complex, real world problems from very early on. However, students often spend time on highly structured tasks which do not leave much time for more creative activities where students can develop their critical thinking skills. Hence, to tackle climate change we need to change not only what we learn, but how we learn.

In sum

Climate change poses one of the biggest challenges that has ever been faced by humankind and education plays a key role in tackling it. Schools and universities need to educate a new generation of students that think critically and have sufficient technical knowledge to assess environmental phenomena. Furthermore, education systems need to promote a sense of environmental awareness and must ensure that students are able to understand the strategic vision required to make longer term gains for future generations.

Even though education plays a crucial role in mitigating and adapting to climate change, simply changing our education systems will not be enough. Governments need to commit themselves to meeting emission targets and to create a system in which effective green innovations can be disseminated nationally and internationally. Responding to climate change will require an unprecedented need for international cooperation between governments, businesses and researchers. International and national actors as well as donor agencies also need to ensure that low income and BRIICS countries (Brazil, Russia, India, Indonesia, China and South Africa), who will be hit hardest by climate change, transition to a path of sustainable development.



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For more information

Contact **Tracey Burns (tracey.burns@oecd.org)**

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