www.jates.org

Journal of Applied
Technical and Educational Sciences
Engineering, Vocational and Environmental Aspects

ISSN 2560-5429

JATES
Journal of Applied
Technical and
Educational Sciences

doi: 10.24368/jates.v7i4.10
https://doi.org/10.24368/jates.v7i4.10

Education in the Sustainability Development Goals (2016-2030), sustainability in the education

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Abstract

The United Nations (UN) accepted the Sustainable Development Goals (2016-2030) for mankind, including 17 Goals and 169 Targets. Sustainability is understood in its widest sense, considering society and economy as equally important pillars, as environmental safety. Fulfilment of these aims needs active and prepared participation of future generations, hence education of these tasks is inevitable. In the paper, a reasonable classification of the Goals is provided, which is missing in the document. This classification sorts the 17 Goals into five groups: *Primary needs of humans* (Goals 2, 3, 6 and 7); *Equality between humans* (1, 4, 5 and 10); *Efficient, sustainable production* (8, 9, 12 and 13); *Landscapes in danger* (11, 14 and 15) and *Worldwide cooperation* (16, 17). Goal 4 is devoted to education with 10 Targets, whereas eight further Targets of six Goals literally mention education or synonyms. Having them briefly presented, the paper critically notes those Targets, where education is also requested, but not mentioned by the document. There are also recommendations on how to teach sustainability in the various secondary school subjects. Reversely, examples are also provided to convince the Reader about possibility and usefulness of applying sustainability to support practically all school subjects and to develop key competences by selected aspects of sustainability. In the Appendices, there are global and European indicators, to be used in education of and by sustainability.

Keywords: SDG (2016-2030); education; school subjects; key competences; global and European indicators

1. Introduction

The term Sustainable Development was effectively distributed by the Bruntland Commission Report (1987) as *"development that meets the needs of the present without compromising the ability of future generations to meet their own needs."* Nowadays, the scope of the Sustainable Development is much wider than the initial concept of environmental sustainability (e.g. Goodland and Daly, 1996). Society and economy are not only preconditions of ensuring environmental sustainability, but both economy and society add to the problems to solve. A recent survey of original and complex concepts of sustainability is provided by Kiss and Morelli (2015). (In this paper, the expressions *sustainable development* and *sustainability* are used as synonyms.)

The sustainability paradigm largely differs from the old paradigm of economic development, according to which the damaging social and environmental consequences were seen as inevitable and acceptable. However, at present it is obvious, that major damage or serious threats to the well-being of humans and the environment are risks for economic development, as well.

Since its establishing, the UN tries to provide peace and prosperity on Earth, as to ensure fair distribution of the goods. Sustainable development as a concept reached public consciousness at in connection with the second Earth Summit (Rio de Janeiro, 1992), where the UN affirmed the program entitled *Tasks for the 21st Century (Agenda 21*). A few years later, in 2000, world leaders formulated eight main goals for the period 2000 - 2015, i.e. the Millennium Development Goals (MDG). Environmental sustainability was only one of the eight goals of the document.

The UN accepted the *2030 Agenda for Sustainable Development* for 2016-2030, including 17 Goals in 2015. This document, integrating all aims of mankind into Sustainable Development, is in the focus of the present study. These goals are compared with the relevant UN documents by Vladimirova and Le Blanc (2015), their financial aspects are considered by Klapper et al. (2016).

The UN organization for education and science, the UNESCO provides teachers' toolkits on sustainable development, the most recent member of this series is dated from 2017 (UNESCO, 2017). The target readers of this series are primary and secondary teachers, as well as those decision-makers, who are responsible for the content and aims of the education, as well, as teacher educators who work in preparation and training of the school teachers.

The 8th World Environmental Education Congress (WEEC, 2015) Summary Report writes *"possibilities for education and learning for a transition away from ... global systemic dysfunction and towards a healthier, more equitable and balance way of living. Not by propaganda, force or prescription but rather by discovering, (re)connecting, questioning, disrupting, experimenting, reflecting and, indeed, continuous learning."* These sentences are our motivations to recommend the Sustainable Development Goals for educational purposes.

2. The UN Sustainability Goals (2016-2030)

The United Nations accepted the 2030 Agenda for Sustainable Development including 17 Sustainable Development Goals (SDG, 2015) including 169 more detailed targets. These goals spread over all environmental, social and economical aspects of sustainability, all over the world. The 17 established Goals, comprehended in Fig. 1, are not ordered into any logical structure.

Figure 1: The pictograms of the 17 Sustainable Development Goals (Harvey, 2016)
(Note, that these pictograms exist in different versions, especially for Goal 3, 9 and 15.)

Table 1: Grouping of the 17 Goals (2016-2030). All original texts are denoted by (“.”):

Group of Goals	Numbered Goals G
Basic human needs	“**2.** End hunger, achieve food security and improved nutrition and promote sustainable agriculture.” “**3.** Ensure healthy lives and promote well-being for all at all ages.” “**6.** Ensure availability and sustainable management of water and sanitation for all.” “**7.** Ensure access to affordable, reliable, sustainable and modern energy for all.”
Equality and justice	“**1.** End poverty in all its forms everywhere. “ “**4.** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.” “**5.** Achieve gender equality and empower all women and girls in their social role.” **“10.** Reduce inequality within and among countries.”
Efficient, sustainable economy	“**8.** Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.” “**9.** Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.” **“12.** Ensure sustainable consumption and production patterns.” **“13.*** Take urgent action to combat climate change and its impacts.*”
Protecting vulnerable environments	„**11.** Make cities and human settlements inclusive, safe, resilient and sustainable. “**14.** Conserve and sustainably use the oceans, seas and marine resources for sustainable development. “**15.** Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.”
Cooperation towards common goals	“**16.** Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.” “**17.** Strengthen the means of implementation and revitalize the global partnership for sustainable development.”

*”Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.”

Even the coloring of the logos do not coincide with any classification of the Goals, though it would be rather useful in memorizing and understanding the goals, i.e. from educational aspects. Hence, a trial is made to classify the goals keeping their original numbering in Table 1. We cannot recommend this classification as the one and only solution. E.g. Goal 7 (energy) is not a human need itself, just the use of it may help them, or Goal 1 (poverty) is also related to basic needs, etc.

The SDG were recommended as a document reflecting the important *5P* for mankind: *people, planet, prosperity, peace, partnership* (SDG, 2015: p. 2). These concepts, however, do not really accompany the document. The first two groups of our classification, the basic needs (No. 2, 3, 6 and 7) and the equity group (No. 1, 4, 5 and 10) deal really with *people*. The next two groups, the production (No. 8, 9, 12 and 13) and the zones in danger (No. 11, 14 and 15) fit to *prosperity* and *planet*, respectively. *Peace* and *partnership* point at the smallest group, cooperation (No. 16-17).

The original 17 Goals contain altogether 169 Targets. From these, 126 Targets contain quantitative objectives, mostly related to 2030. The rest of the Targets point at organisation needs as preconditions of the objective targets. As a rule, the quantitative targets are marked by numbers, and the latter ones by letters. Let us cite examples for both related to Goal 1:

> **"1.1** By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than $1.25 a day."
>
> **"1.b** Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions."

Let us remark, that there is one Goal which is problematic to select into any of the groups. This is *Goal 13. Climate action*, since climate change is the only environmental problem which is tackled as a separate Goal in the SDG (2016-2030). All other problems, like reduction of biodiversity, ozone depletion, etc. are considered in other goals as their effects on the vulnerable spheres or on the human health. Another remark is that this Goal refers to the Paris Agreement (2015) which deals with several aspects of climate change, not mentioned by this Goal.

3. Education in the SDG

3.1. Goal 4 on Education

One goal among the 17 ones is devoted to education (*Table 2*). The first three targets (4.1 – 4.3) list the tasks according to the age of the pupils, emphasizing that free basic and secondary school education should be available for everyone. Pre-school and post-school educations are

also included, though they may be of lower priority, as it is reflected by the sequence of the targets.

The next three targets (4.4 – 4.6) are qualitative requirements of education, such as: providing vocational skills for successful employment; inclusivity of the schools in various aspects; as well, as literacy and numeracy should fully characterise the younger generations.

Goal 4.7 requests knowledge on sustainable development, whereas the background conditions (4.a – 4.c) require development of inclusive schools; special financial funds and education-oriented professions in higher education and enhance the education of teachers.

Table 2. Original text of Goal 4 devoted to education, and its targets in the SDG (2016-2030)

Target	**"Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all"**
4.1	"By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes"
4.2	"By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education"
4.3	"By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university"
4.4	"By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship"
4.5	"By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations"
4.6	"By 2030, ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy"
4.7	"By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development"
4.a	"Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all"
4.b	"By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries"
4.c	"By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island developing States"

One should note that there is a missing aspect of higher education which is the key for any society to be able to successfully adapt the newest elements of innovation. This means not only technology, but social aspects of organizing our work or everyday life. Training capable intelligence is not mentioned in Goals 9 either.

In Section 3.3 we will provide several examples in connection with those Targets where education is required to fulfil the aims but education is not mentioned, but let us see, where and how education is reflected in the Targets of the SDG (2016-2030).

3.2. Education explicitly mentioned in other Goals

There are eight further Targets in the SDG where education or related expressions are definitely mentioned (Table 3). They represent six Goals. Three of them (2.2, 2.5 and 3.7) are related to food and health. Another one claims to reduce number of young people without both job and school. Furthermore, two Targets that emphasize necessity of education on sustainability and on its partial aspect, climate (12.8 and 13.3, following 4.7 see above in Table 2). Finally, two Targets mention knowledge transfer, as an aim of partnership and cooperation (17.6 and 17.16).

Table 3. Targets of SDG (2016-2030) definitely mentioning education or its synonyms

Target
2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and **equal access to** land, other productive resources and inputs, **knowledge**, financial services, markets and opportunities for value addition and non-farm employment 2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and **fair and equitable sharing of benefits** arising from the utilization of genetic resources and associated **traditional knowledge**, as internationally agreed
3.7 By 2030**, ensure universal access to** sexual and reproductive health-care services, including for family planning, information and **education**, and the integration of reproductive health into national strategies and programmes
8.6 By 2020, substantially reduce the proportion of youth **not in** employment, **education or training**
12.8 By 2030, **ensure that people** everywhere **have** the relevant **information and awareness** for sustainable development and lifestyles in harmony with nature
13.3 **Improve education,** awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
17.6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and **enhance knowledge sharing** on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism 17.16 Enhance the Global Partnership for Sustainable Development, complemented by multi-stakeholder partnerships that , expertise, technology and financial resources, to support the achievement of the Sustainable Development Goals in all countries, in particular developing countries

Besides these Goals (4 for education, 2, 3, 8, 12, 13 and 17) definitely mentioning education, in fact, all the other ten Goals are somehow related to education and to its result, knowledge and competence. These Goals are detailed in the next Section.

3.3. Education implicitly needed to fulfil other Goals

The various challenges to be met by Mankind in the next 15 years require much improvement mostly requesting new knowledge and competence from many of us. In general, this means learning or education on the other side. *Table 4* displays a list of the ten Goals not mentioning education explicitly, and selected aspects to be considered in respect to the given Goal, if one wishes fulfillment of it. The missing education could also be mentioned concerning the Targets.

If conditionally classifying our knowledge as natural sciences, social sciences and technology, the missing aspect require all these sectors in equal distribution, i.e. five times (50% of the ten Goals): Natural sciences are noted in connection with Goals 1, 6, 11, 14 and 15. Social sciences have significant effect on Goals 1, 5, 10, 11 and 16. Education of technology is inevitable to meet the challenges of Goal 1, 6, 7, 9 and 11.

Goals 1 (Poverty) and 11 (Urban problems) need all kinds of knowledge, sorted above in three classes. Goal 6 (water and sanitation) needs natural and social sciences, all the other Goals from the ten investigated in this section need only one of the above science groups.

It is sad that the working groups elaborating the various Goals did not consider these aspects.

Table 4. Goals not explicitly mentioning education, though learning is inevitable to fulfill the given targets

	Goal	Missing aspect
1.	End poverty in all its forms everywhere	Lack of education and poverty do interact. Good education helps to eradicate poverty.
5.	Achieve gender equality and empower all women and girls	In many societies the equal right of female members of family is not obvious. Equality should be learned there.
6.	Ensure availability and sustainable management of water and sanitation for all	To achieve this goal highly educated directors, well trained staff and developers are needed, at all levels.
7.	Ensure access to affordable, reliable, sustainable and modern energy for all	This is a fast developing complex industry, hence life-long professional learning is inevitable.
9.	Build resilient infrastructure, promote inclusive, sustainable industrialization and foster innovation	This, knowledge- and innovation-intensive Goal needs the best technological education.
10.	Reduce inequality within and among countries	Acting against interests in keeping the inequalities needs high level education of social sciences.
11.	Make cities and human settlements inclusive, safe, resilient and sustainable	Geography as natural and social science, in one, helps to understand the urban problems. However, specific multidisciplinary education is needed to solve them.
14.	Conserve and sustainably use the oceans, seas and marine resources for sustainable development	People have no experience with the oceans, hence this goal especially needs higher education.
15.	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	Acting for this goal needs the highest level and interacting natural science education. The task needs not only educated theoreticians, but communicators to convince or overcome those of counteracting interests.
16.	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels	Knowledge is not enough to reduce crime and terrorism. Social sciences help to understand. Teaching by good examples finds the solution.

4. Opportunities of educating of and by sustainability

Sustainability can be included into education in two ways. Either we teach components of sustainability, and turn the students' attention towards its aspects or we use sustainability to achieve other educational goals e.g. to emphasize topics of given school subjects, or to develop competences. Focusing at the SDGs, the first way is described in Section 4.1 and the second one is compiled in Section 4.2. Appendix A and B provide examples to be applied in both directions.

4.1. Aims to educate the sustainability goals and targets

Since sustainable development contains all aspects of our life, if the school subjects have any connection to the present, past or future of mankind, this should not be difficult to find places in any school subject where one or the other aspect of sustainability can be successfully presented.

Table 5 presents selection of school subjects of the secondary schools in Hungary, arbitrarily classified as social sciences, human culture and natural sciences. The initial number of the subjects was 19, but *Dance and motion* would be difficult to apply for education of sustainability, whereas in case of *Visual art* too many goals should be mentioned. So, the number of school subjects is 17, i.e. the same as number of Goals in the SDG (2016-2030). We equally distributed each Goal among the subjects, aimed to find characteristic subjects for each Goal.

Though it would be too long to explain how to include sustainability into each subject, but we shortly do it for one subject from the three groups. From among the six subjects of *Social sciences*, we refer to the Native language and literature, providing excellent possibilities to use such abstract concept as e.g. *inclusive societies, accountable institutions, abuse, trafficking, torture and illicit financial flows* (Goal 16) or *tax and revenue collection, official development assistance, mobilize financial resources, debt relief and restructuring, stakeholder, race vs. ethnicity, dissemination and diffusion, environmentally sound technologies, duty-free and quota-free market access* (Goal 17).

Table 5. The two most relevant sustainability goals feasible to emphasize in the secondary school topics in Hungary (http://kerettanterv.ofi.hu/03_melleklet_9-12/index_4_gimn.html)

School subject	Goals to explain
Social Sciences (6)	
Native[a] language and literature	Goal 16. Peace and justice; Goal 17 Partnerships for the goals
Foreign languages[b]	Goal 8. Good jobs, economic growth; Goal 15. Life on land
History[c]	Goal 1. No poverty; Goal 10. Reduce inequalities
Economy[c]	Goal 2. No hunger; Goal 8. Good jobs, economic growth
Philosophy	Goal 12. Responsible consumption; Goal 17 Partnerships for the goals
Ethics	Goal 5. Gender equality; Goal 14. Life below water
Human culture (5)	
Physical education and sport	Goal 3. Good health; Goal 10. Reduce inequalities
Song and music	Goal 13. Climate action; Goal 15. Life on land
Theatre and dance	Goal 5. Gender equality; Goal 16. Peace and justice
Motion picture and media	Goal 1. No poverty; Goal 14. Life below water
Technology and way of living	Goal 4. Quality education; Goal 7. Renewable energy
Natural Sciences (6)	
Mathematics	Goal 4. Quality education; Goal 13. Climate action
Information technology	Goal 9. Innovation, infrastructure; Goal 12. Responsible consumption
Physics	Goal 7. Renewable energy; Goal 9. Innovation, infrastructure
Chemistry	Goal 6. Clean water, sanitation; Goal 11. Sustainable cities and communities
Biology	Goal 2. No hunger; Goal 3. Good health
Geography	Goal 6. Clean water, sanitation; Goal 11. Sustainable cities and communities

[a]Hungarian, in most cases; [b]two of them compulsory in the secondary schools; [c]inc. social and civic knowledge

Note, that these examples are written in their original English wording, here. In national languages, finding the correct expressions need additional preparation of the teachers until the common education tools provide these correct translations and explanations.

From five subjects of the *Human culture* group let us select the subject Motion picture and media which demonstrate the selected Goals (see in Table 5) in the most straightforward manner. Poverty (Goal 1) is mostly seen in the developed countries or in those locations of the given country where majority of the students do not appear at all, or spend as short time, as possible. Concerning the wonderful but also threatened underwater life (Goal 14) it is even more difficult to find any personal experience among the pupils. So, good selection of movie scenes with brief explanations helps the students to discover and internalize both aspects of sustainability.

Finally, from six subjects of *Natural sciences* Geography is the subject where the selected Goals can be easily demonstrated. Facts of water availability and canalization (Goal 6), and the urban problems, mostly connected to over-population (Goal 11). Both aspects can be efficiently presented over each continent of the world and in the detailed description of a given country.

Another tool to expose various aspects of sustainability and to convince our audience about the usefulness of the systemic approach to our life is to collect all related Targets to one problem. In Table 6, there are those 21 Targets collected, which are related to the selected problem of *water management*. This means the 8 Targets which are obviously related to the problem in Goal 6, but there are further 13 Targets of nine further Goals, that are devoted to poverty, food, health, energy, cities, sustainable production and consumption, climate, oceans and lands.

The first four targets are related to such threats, as shorter and longer term weather extremes and pollution of water by water-born diseases and by chemicals. The eight Targets of the Goal 6, focused on water and sanitation, denote aims concerning quantity and quality of water (first three Targets) and defines tools for water management to achieve them (next three targets). The two number.letter Targets urge professional capacity building, especially in the developing countries, and participation of local communities to solve the problems.

In the nine remained targets there are two pairs which are relate to the cities, the oceans and the lands, i.e. the vulnerable environments. For the cities the aim of decreasing the victims of environmental catastrophes and enhancing the resilience against them are requested. Concerning the oceans, reduction of marine pollution and of effects of inadvertent CO_2 pollution, leading to acidification of the oceans, are declared. Concerning adequate treatment of freshwaters and combating desertification is emphasized concerning the water problems. The remained three Targets point at water energy as the widest form of renewable energy, whereas two other Targets practically repeat the requests decrease the environmental pollution and the effects of disasters.

Table 6. Example of focusing at one problem: the water management in 21 Targets of the SDG (2016-2030)

Targets
1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability **to climate-related extreme events** and other economic, social and **environmental shocks** and disasters
2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change**,** extreme weather, **drought, flooding** and other disasters and that progressively improve land and soil quality
3.3 By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, **water-borne diseases** and other communicable diseases
3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, **water** and soil **pollution** and **contamination**
6.1 By 2030, achieve universal and equitable access to safe and affordable **drinking water** for all
6.2 By 2030, achieve access to adequate and equitable **sanitation and hygiene** for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations
6.3 By 2030, improve **water quality** by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
6.4 By 2030, substantially **increase water-use efficiency** across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially **reduce** the number of people suffering from **water scarcity**
6.5 By 2030, implement **integrated water resources management** at all levels, including through transboundary cooperation as appropriate
6.6 By 2020, **protect and restore water-related ecosystems**, including mountains, forests, wetlands, rivers, aquifers and lakes
6.a By 2030, expand international cooperation and capacity-building support to developing countries **in water- and sanitation-related activities** and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies
6.b Support and strengthen the participation of **local communities** in improving water and sanitation management
7.2 By 2030, increase substantially the share of **renewable energy** in the global energy mix
11.5 By 2030, **significantly reduce** the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including **water-related disasters**, with a focus on protecting the poor and people in vulnerable situations
11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, **resilience to disasters**, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels
12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly **reduce their release to** air, **water** and soil in order to minimize their adverse impacts on human health and the environment
13.1 Strengthen resilience and adaptive capacity to **climate-related hazards** and **natural disasters** in all countries
14.1 By 2025, prevent and significantly **reduce marine pollution** of all kinds, in particular from land-based activities, including marine debris and nutrient pollution
14.3 **Minimize** and address the impacts of **ocean acidification**, including through enhanced scientific cooperation at all levels
15.1 By 2020, ensure the **conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems** and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements
15.3 By 2030, **combat** desertification, restore degraded land and soil, including **land affected by** desertification, **drought and floods**, and strive to achieve a land degradation-neutral world

4.2. Supporting education by sustainability goals and targets

Besides treating sustainability as a topic of our teaching, it is easy to find examples in the majority of school subjects, where sustainability may be used as supporting tool for particular subject topics, as provided in Table 7 for the six above subjects of natural sciences.

Let us explain the examples of just one school subject, Physics. Importance of material sciences can be made well understood by explaining how solar energy is transforming into electricity in the solar cells, or what kind of and how strong forces the rotors of a wind-mill should compensate. Solution of the energy accumulation could provide examples for various basic laws of thermodynamics. Working of a dynamo can be illustrated in water energy plants, together with potential and kinetic energy, as a by-product.

Table 7. Examples for teaching school topics supported by referring sustainability in the various natural sciences

Sciences	Examples for teaching the given topic referring sustainability
Informatics	automatic switches to alternate the energy sources, information mining
Mathematics	Fibonacci numbers (reproduction of animals), decision matrices, angle functions
Physics	material sciences, solution of energy accumulation, working of a dynamo
Chemistry	bio-energy formation and utilisation, save the devices from corrosion, etc.
Biology	optimize for green mass (instead of grain mass), recognition of bird flies towards wind mills
Geography	spatial distribution of the energy sources, role of local social structure and financial ability

Development of the nine key competences fixed by the National Core Curriculum (NCC, 2012) for Hungary is an equally important goal of the education than learning of the thematic school-subjects. (They are derived from the eight EU competences by separating the science and mathematical competences.) In Table 8 the key competences are listed, together with examples how the given competence can be improved by studying the Sustainable Development Goals.

In case of mother tongue and foreign languages, the abstract nature of sustainability may help to learn expressions that are rare in everyday talking, together with possibly enhanced interest of the pupils to individually elaborate specific topics of sustainability. For mathematical, scientific, technical and digital competences the common core is to convince the pupils how important these competences are for sustainability of mankind, i.e. how important those pupils can be for the society who develop high level in one or more of these similar competences.

For the next three competences, i.e. for Social and civic competence, Sense of initiative and entrepreneurship, and Aesthetic and artistic awareness and expression, sustainability may be too complex to be directly applied to improve these competences, but pointing at just one Goal, e.g. taking over the hunger of people or saving the underwater world for animals is well applicable to improve these competences, too. Finally, for improving the Efficient and independent learning competence, the rather interdependent nature of sustainability is an attractive feature.

Of course, both the school subjects and the competences can be supported by sustainability not at the very abstract level of the SDG Targets. They must be interestingly illustrated which requests extra efforts from the teachers. After the Conclusion, Appendix A and B are devoted to help providing such illustrations for teaching by and of sustainable development.

Table 8. Examples of possible use of SDG (2016) to develop key competences

Key competence	**Examples of using SDG to develop the KC**
Communication in the mother tongue	
	• learn new words of various aspects of SDG
Communication in foreign languages	
	• find extra motivation in understanding the SDG
Mathematical competence	
	• emphasise examples where math is used to fulfil one or other SDG
Competences in science and technology	
	• emphasise examples where science is inevitable to fulfil one or other SDG
Digital competence	
	• besides the Internet, expose IT as a key to improve efficiency of mankind
Social and civic competence	
	• emphasise good examples of co-operation in natural catastrophe threats
Sense of initiative and entrepreneurship	
	• emphasise successful firms e.g. in renewable- and low-carbon industry
Aesthetic and artistic awareness and expression	
	• endangered landscapes may be picturesque examples to enjoy and understand
Efficient and independent learning	
	• request individual analysis of interesting SDG aspect to learn for learning

5. Conclusion

The concept of sustainable development gained new importance after the United Nations declared the 17 Goals for mankind in 2015. As it is also mentioned in the Introduction of the present study, this renaissance of the concept should be reflected by the education, as well.

Lack of logical order in these thoughts about our Future hampers the understanding and memorizing them by a student. Section 2 provides a classification of the Goals having defined *Primary needs of humans* (4 Goals); *Equality between humans* (4 Goals); *Efficient, sustainable production* (4 Goals); *Landscapes in danger* (3 Goals) and *Worldwide cooperation* (2 Goals).

Section 3 introduces the Goal 4 and its eight Targets which are completely devoted to education. This Section points at those eight targets in six Goals which definitely contain the word *education* or its synonyms, too. Finally, this Section lists and comments the other ten Goals which do not directly refer to education. These comments establish the aspects in each Goal which make easily understood that fulfilment of the goals is impossible without learning in its narrow or more general meaning.

In Section 4 possibilities for teaching of sustainability are provided in two ways Firstly, 17 secondary school subjects are listed and the two most characteristic Goals of the SDG (2016-2030) are joined to each subject. Secondly, an example of the possibility to collect all Targets related to a selected topic is illustrated in the example of water management. This section also gives examples how teaching natural sciences can be supported by sustainability, and how the key competences can be improved by studying sustainability. These, possibly abstracted educational possibilities are supported by worldwide and European illustrations in form of Figures in the Appendices A and B.

APPENDIX A. Global facts behind the Goals – illustrations for education

In this Appendix A, there are figures recommended to use in education of sustainability, more specifically, the UN Sustainable Development Goals. The illustrations are grouped according to the classification of the 17 Goals in Section 2. The altogether 25 images are selected from the UN SDG Report (2016). The figures are supplied with explaining texts, so we would write about the common messages of the selected Figures A1-A6.

Figure A1 provides us facts that global hunger and health conditions are though improving, but still not satisfactory. The fresh and waste-water data show the dark side of the picture, only.

Figure A1. Illustrations for *Basic human needs* (Goals 2, 3, 6): Facts about hunger and health (left side figures, upper and lower), as well, as fresh and waste-water conditions (right side) (UN SDG Report, 2016: pp. 4 and 6)

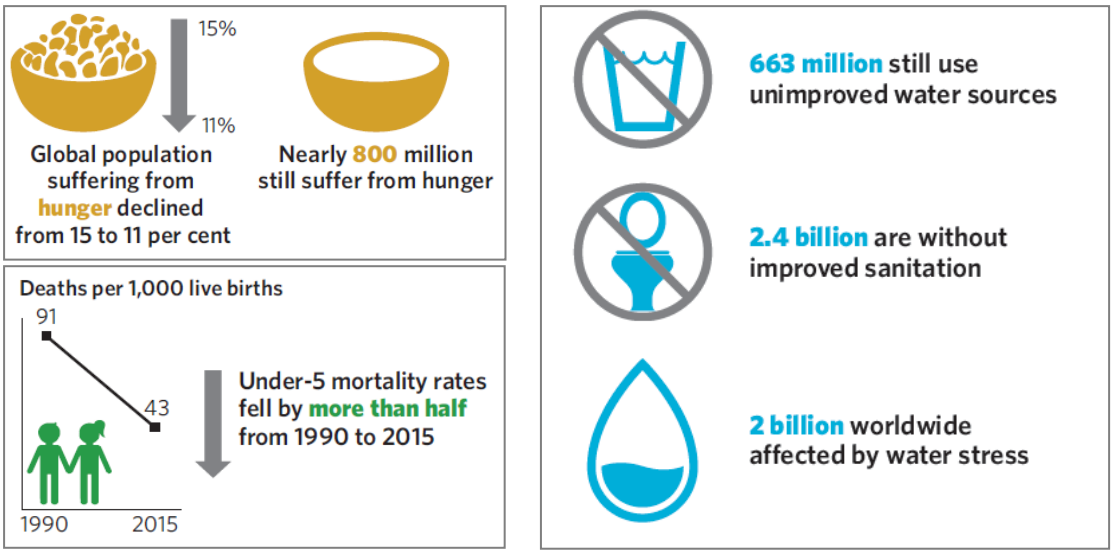


Figure A2. Illustrations for *Energy, climate and oceans* (Goals 7, 13, 14): Facts about energy (left side figures, upper and lower), natural disasters and fishery (right side, upper and lower) (UN SDG Report, 2016: pp. 6 and 9)

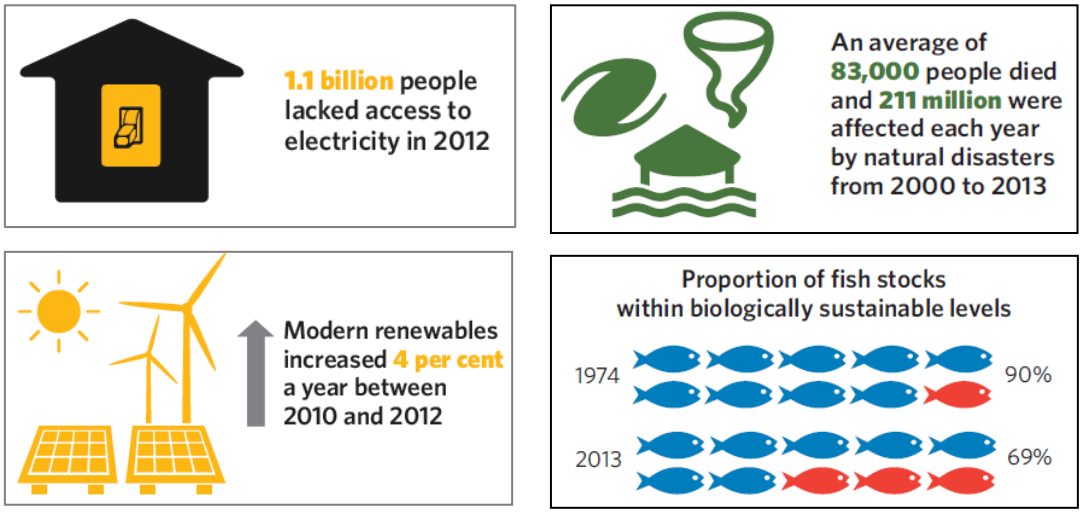


Figure A2 comprehend sorrow facts and good tendencies on energy supply, together with the numbers natural catastrophes and the degrading fish stocks. The right pair of images are related to the "Basic human needs" group of goals. Natural disasters are possibly related to climate change, whereas conditions of fish stock represent a key problem of the underwater world.

Figure A3 illustrates proportions of poverty, illiteracy, gender inequality in the politics and, as positive impression, decreasing gap between poor and average households in the majority of investigated countries, though the income gap is increasing in almost the half of the countries.

Figure A3. Illustrations for *Equality and justice* (Goals 1, 4, 5, 10): Facts on poverty and illiteracy (left side figures, upper, lower), gender and income inequalities (right side upper and lower) **(**UN SDG Report, 2016: pp. 3, 6 and 8)

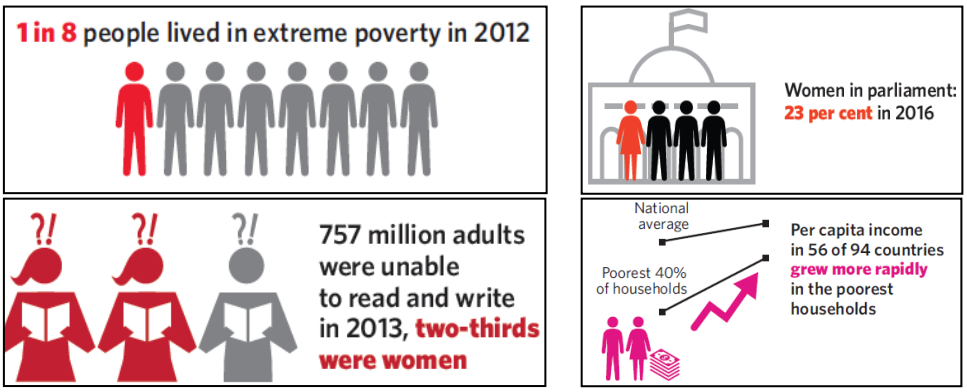


Figure A4. Illustrations for *Efficient, sustainable economy* (Goals 8, 9, 12): Facts on GDP and footprints (left side figures, upper and lower), productivity and phones (right side, upper, lower) For the abbreviations: GDP – Gross Domestic Product, LDC – Least Developed Countries. (UN SDG Report, 2016: pp. 7 and 8)

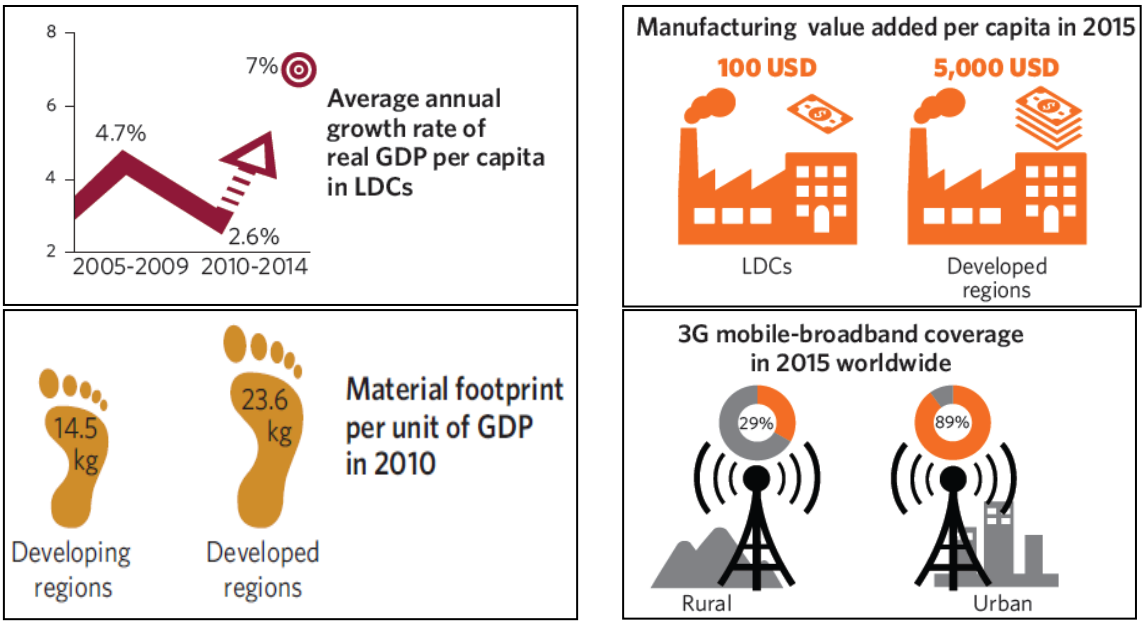


Figure A4 compares developed and less developed countries and regions in their GDP rates, material footprints, per-capita productivity and mobile network availability, world-wide.

Figure A5 provides examples of problems in urban life and loss in forests and biodiversity. The common message is: The tendencies are mostly improving, but there are still very bad indicators concerning these vulnerable domains. Total area of the forests was 4,00 billion ha in 2014 (World Bank, 2017), so the relative loss of forests is considerably decreasing, as well.

Figure A5. Illustrations for *Protecting vulnerable environments* (Goals 11, 15): Facts on urban problems (left side figures, upper, lower), loss of forests and species (right side, upper, lower) (UN SDG Report, 2016: pp. 8, and 10)

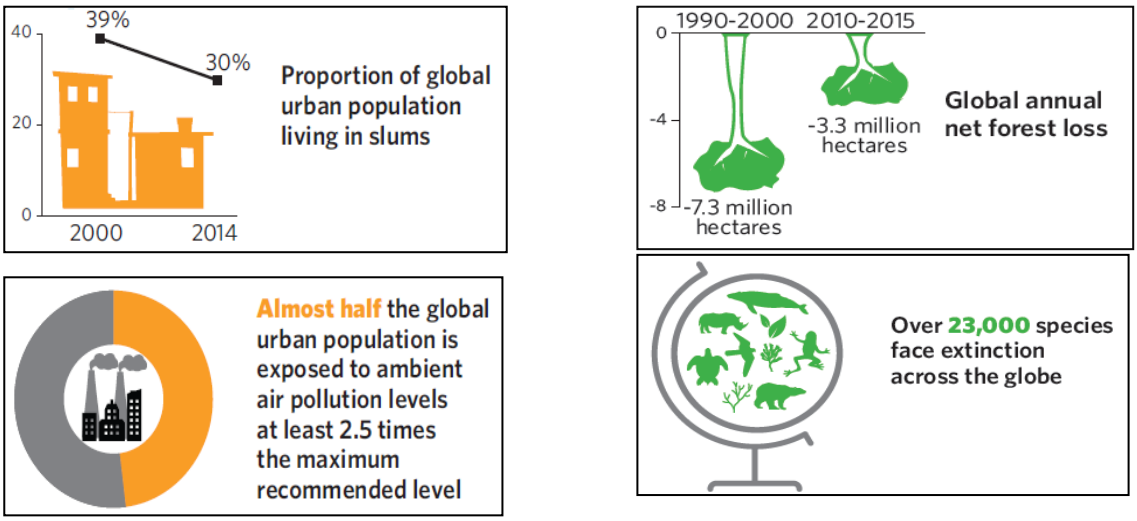
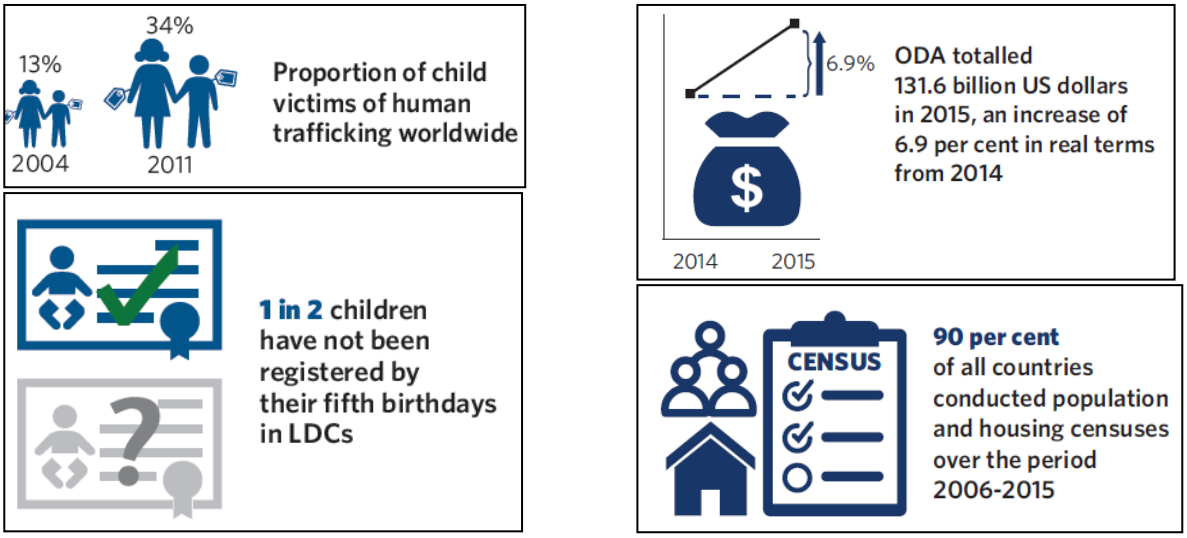


Figure A6. Illustrations for *Cooperation towards common goals* (Goals 16, 17): Facts on risks for children (left side figures, upper, lower), supporting fund and censes (right side, upper, lower) (UN SDG Report, 2016: pp. 10, and 11)



Finally, Figure A6 provides examples that support the need for strong institutions, including registration of inhabitants and statistical census, together with good tendency of Official Development Assistance (ODA) and bad tendency of child trafficking. (Increase of children's percentage reflects increase in absolute numbers, as global trafficking increases (UNODC, 2016)

In addition to the global illustrations, the next Appendix collects European indicators.

APPENDIX B: Selected facts from Europe – illustrations for education.

Figure B1 reflects the uneven distribution of population in the 28 countries of the European Union, as well, as of the trans-continental road network. For population, topography and climate conditions may explain the differences. For the roads, they are partly just questions of definition.

Figure B1. Illustrations for population density (capita/sq. km, in 2011: left figure) and Trans-European road network (2013, right figure) in the 28 EU countries (CSO, 2016: Figures 1.4 and 1.23)

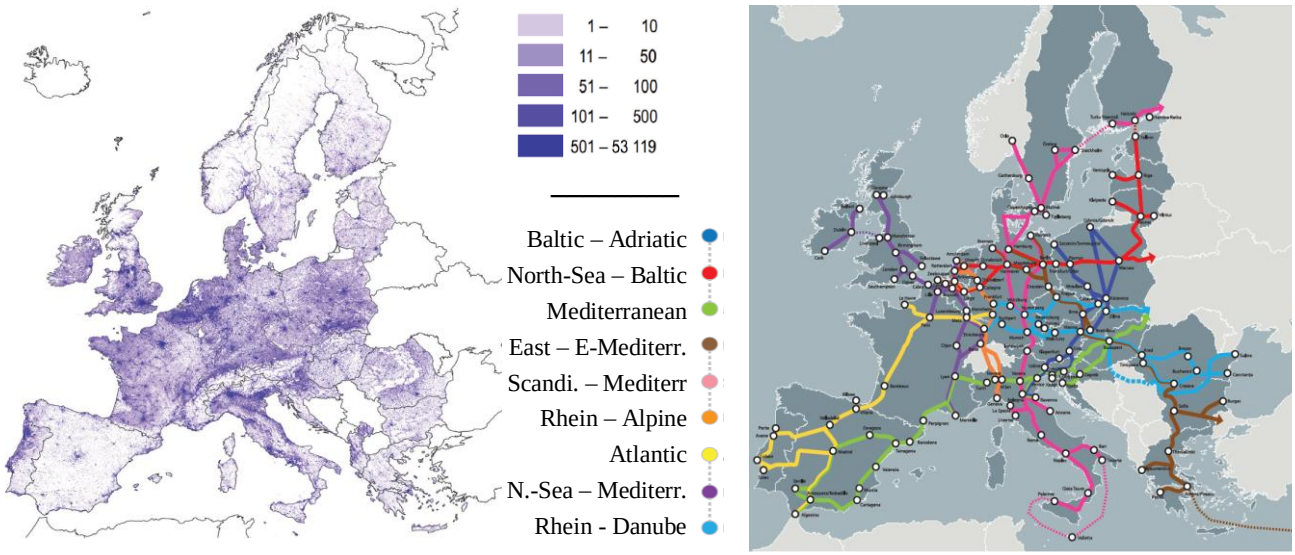


Figure B2. Illustration for education: percentage of people with higher education (university and college) diploma in the 28 EU countries compared to the total population in 2015 (CSO, 2016: Fig. 1.7)

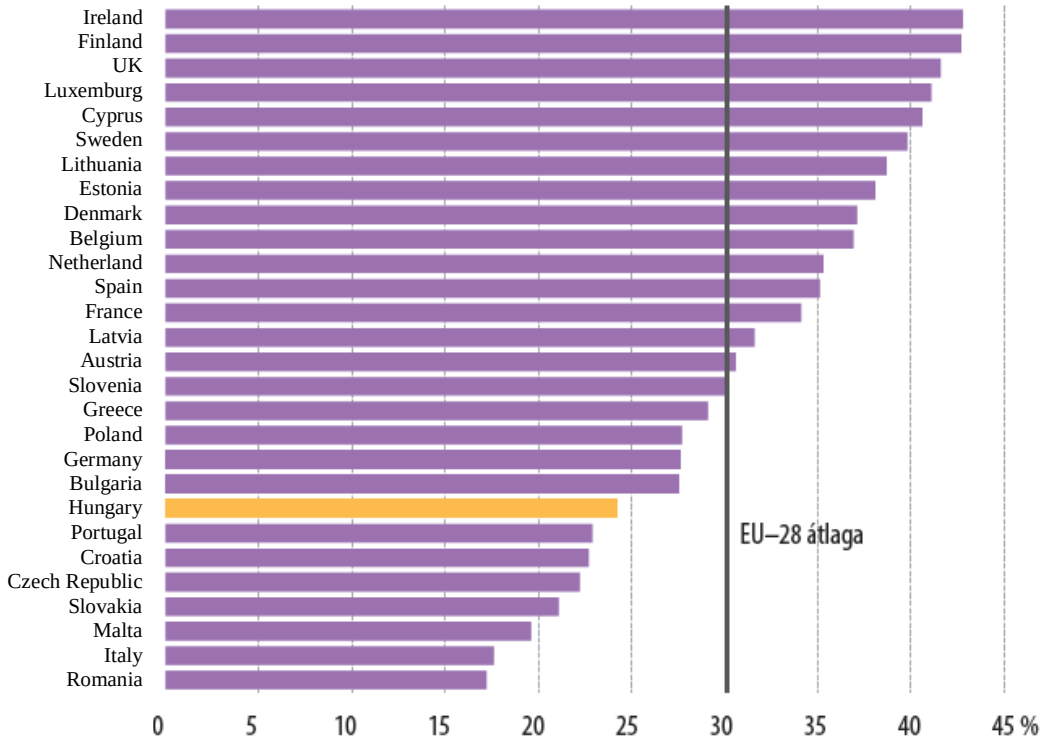


Figure B2 lists the proportion of population in the 28 countries holding diploma of higher education. In its first third (9 countries) one finds seven countries from the core EU-15 countries, only Lithuania and Estonia represent the more recently joined 13 countries. In the less educated third, only Italy and Portugal represent the core EU-15 from this set of nine countries.

Figure B3. Illustrations for social and productivity conditions in the 28 EU countries: Percentage of active workers compared to the 15-64 years' population and active workers' per capita productivity compared to the EU mean (both in 2015, left side figures, upper, lower), percentages of people living below the EU poverty threshold and of new enterprises existing after two years (both in 2014, right, upper and lower) (CSO, 2016: Figs. 1.8, 1.9, 1.10 and 1.18)

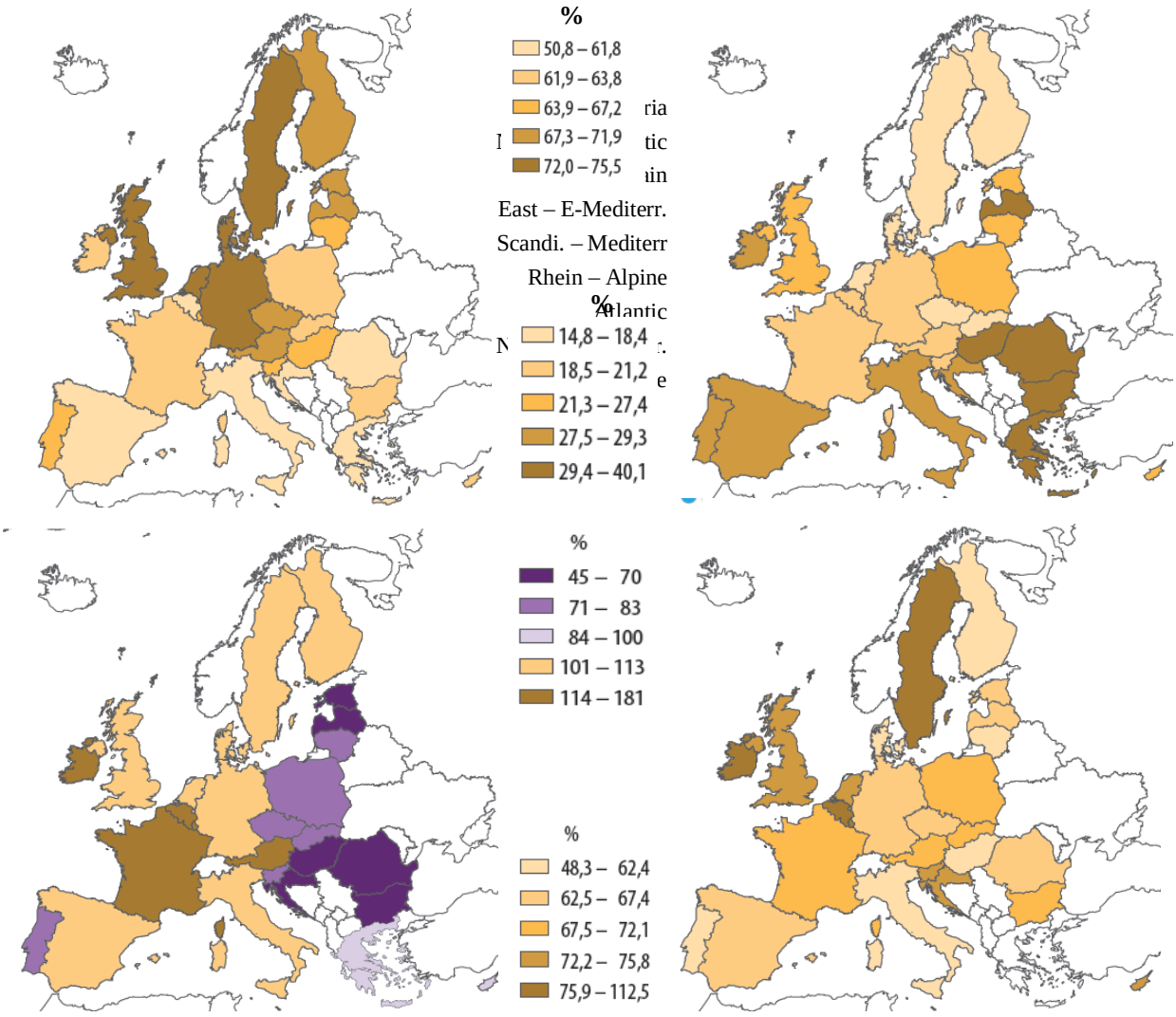
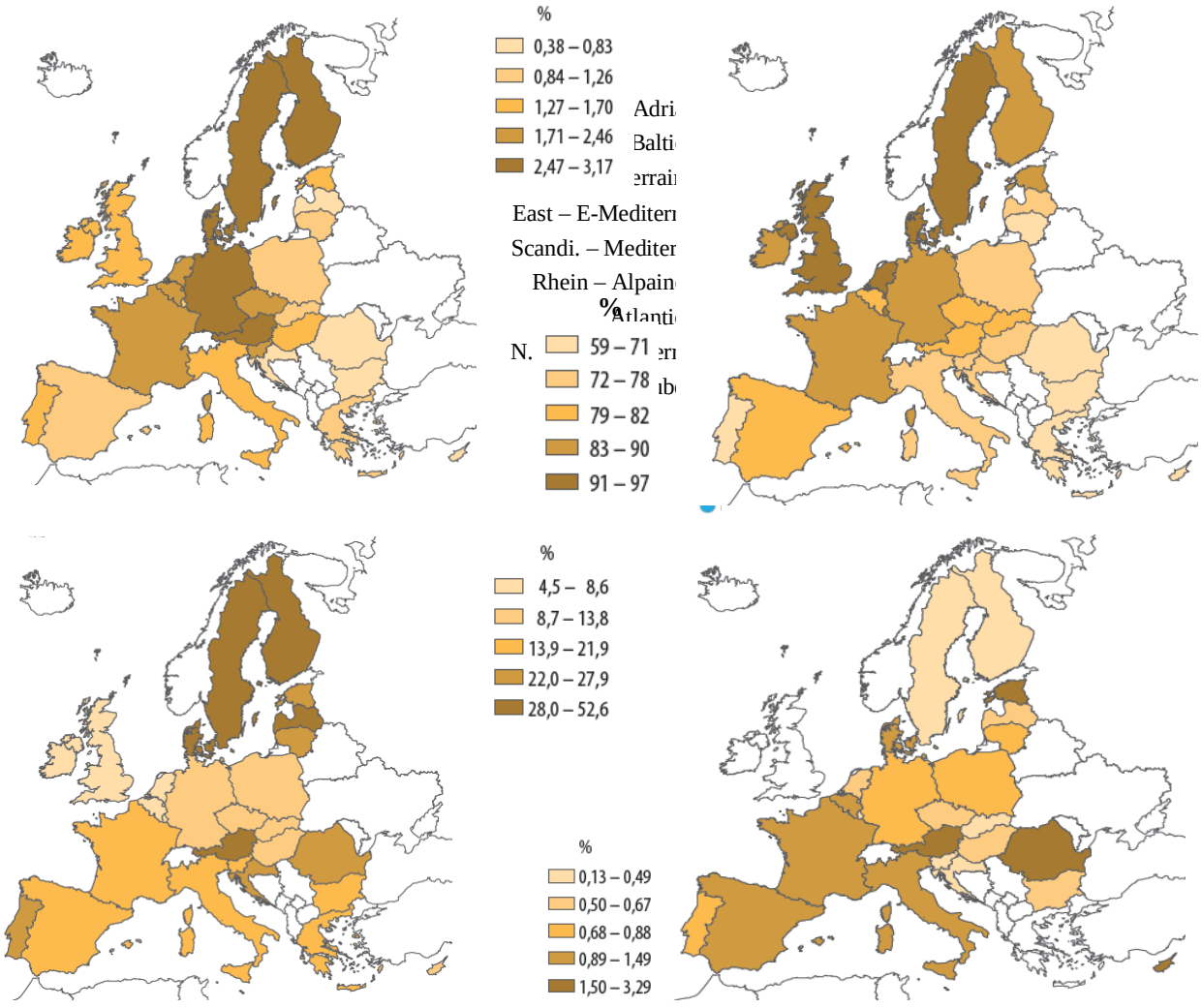


Figure B3 provides four maps on distribution of social and productivity in the 28 EU countries. Our present aim is not to analyse all these aspects, what can be done by the teachers who apply any one or all these figures according to their listeners. For example, on the active workers' per capita productivity (lower left panel of Fig. B3), one can emphasize that besides the differences between east and west, even the western countries are not of same colour, i.e. productivity.

In order to point at similarity between the maps, the Spearman's rank correlation between is calculated per capita productivity and the proportion of poor households. Its -0.41 value indicates that high productivity of a country often coincides with low poorness proportion, and vice versa.

Figure B4 provides four maps on distribution of support for innovation and environment, in percentage of GDP for the given country, as well, as selected indicators for these conditions in the 28 EU countries. Unfortunately, proportional support for environment is not known for Ireland, UK and Greece. Here the most interesting feature is, that the environmental investments compared to the GDP (lower right figure) have no east-west differences. This is connected with the fact that not only the wealth of a country but the condition of the environment determines this finance.

Figure B4. Illustrations for innovation and environmental conditions in the 28 EU countries: Percentages of R+D support compared to GDP and of renewable energy sources in the energy consumption (both in 2014, left side figures, upper, lower), percentages of households with broad-band Internet availability (2015) and of environmental investments (2012) compared to GDP (right, upper and lower) (CSO, 2016: Figs. 1.19, 1.24, 1.21 and 1.26)



The above Figures of Appendix A and B are arbitrary selections. In our age, a teacher can find many other ones to illustrate any aspect of sustainability. Complexity of the figures, presented for the students, depends on the age (level of abstraction) and on the interest of the group we would deal with. The more complicated the given aspect is, the more key facts are requested.

References

Bruntland Commission Report (1987): Our Common Future. Report of the World Commission on Environment and Development 300 p. *(http://www.un-documents.net/our-common-future.pdf)*

CSO, 2016: Tér-kép 2015 (Space in maps) Central Statistical Office, Budapest, 103 p. (http://www.ksh.hu/docs/hun/xftp/idoszaki/pdf/ter_kep_2015.pdf)

Goodland, R. and Daly, H. (1996). Environmental Sustainability: Universal and Non-negotiable. Ecological Applications, Vol. 4. No. 6. 1002–1017. o.

Harvey R. (2016). Co-ops commit to UN Sustainable Development Goals. Retrieved from http://www.thenews.coop/106853/news/co-operatives/co-ops-commit-un-sustainable-development-goals/

Kiss, K. and Morelli J. (2016). Discussing Sustainability. LAP Lambert Acad. Publishing 129 p.

Klapper, L., El-Zoghbi, M. and Hess J. (2016). Achieving the Sustainable Development Goals. The role of financial inclusion. 20 pp. Retrieved from *https://www.cgap.org/sites/default/files/Working-Paper-Achieving-Sustainable-Development-Goals-Apr-2016.pdf*

NCC (2012): The Governments Decree No. 110/2012. (VI. 4.) on the issue, introduction and implementation of the National Core Curriculum**.** 219 p. Retrieved from: *regi.ofi.hu/download.php?docID=5846* Translated according to the Hungarian version published in Magyar Közlöny (Official Journal of Hungary) No. 66. pp. 10635-10847

Paris Agreement (2015): Paris Agreement United Nations 27 p. (*http://unfccc.int/files/essential_background/convention/application/pdf/english_paris_agreement.pdf*)

SDG (2015). United Nations Resolution A/RES/70/1 of 25 September 2015. The Goals are listed in par. 51 (http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E)

UN SDG Report (2016): The Sustainable Development Goals Report, United Nations, New York, 56 p (Retrieved from *http://www.un.org.lb/Library/Assets/The-Sustainable-Development-Goals-Report-2016-Global.pdf*)

UNESCO (2017): Education for Sustainable Development Goals: Learning Objectives. UNESCO Education Sector, UNESCO Paris ISBN 978-92-3-100209-0 1-67 pp. http://unesdoc.unesco.org/images/0024/002474/247444e.pdf

UNODC (2016): Global Report on Trafficking in Persons 2016 (United Nations publication, Sales No. E.16.IV.6). 1-121 pp.

Vladimirova, K. and Le Blanc D. (2015): How well are the links between education and other sustainable development goals covered in UN flagship reports? A contribution to the study of the science-policy interface on education in the UN system. DESA Working Pap. No. 146, 32 p. Retrieved from *http://www.un.org/esa/desa/papers/2015/wp146_2015.pdf*

WEEC (2015): Summary Report. World Environmental Education Congress, June 29-July 2, 2015, 8th Gothenburg Sweden, 23 pp. Retrieved from http://weec2015.org/wp-content/uploads/2015/08/WEEC2015-Summary-Report.pdf

World Bank (2017): Forest area (sq. km). Food and Agriculture Organization. (https://data.worldbank.org/indicator/AG.LND.FRST.K2?end=2015&start=1990&view=chart)