CLIMATIC CHALLENGES EDUCATED FOR PROSPECTIVE TEACHERS OF GEOGRAPHY

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Abstract: Weather and climate are important conditions for our everyday life, and also frequent topics of the media. For the teachers this means a life-long challenge to be always informed when contacting the students. Teachers of geography are especially involved in this respect, so curricula of their higher education should prepare them for this role, accordingly.

The study presents four subjects of the regular curricula in the College represented by the authors. They are "Meteorology and hydrology" and "Renewable energy sources" in the BSc. programme, "Atmospheric risks and resources" and "Climate change, impacts and responses" in the MA education. These subjects provide the necessary topical information for the students.

In the sequence of the subjects, they are the continuous technological innovation, leading to ever developing services; the technological and social conditions supporting or limiting the ideal carbon-free way of living; the series of examples to accept precautionary measures in connection with the atmospheric risks and the smarter site-specific consumption of our natural resources. The climate change subject provides good opportunity to present the related problems of the environment, stemmed from the same anthropogenic over-consumption of the natural resources. This last subject claims for integration of these moments into long-term tasks for the whole society.

Key words: *climate change, meteorology, geography, teacher education, e-learning.*

1. Introduction

Climate change is one of the most exciting scientific and practical challenges of our era. Acting today in this regards yields positive results for the next generation. This is why the young generation should also be involved into the circle of these pieces of knowledge to motivate them for contributing to focused response of society in mitigation of the changes and in adaptation to them.

Department of Geography at the Eszterházy Károly College tries to take its due part from this discussion among the generations. This activity is realised in widening of its BSC and MA curricula and also in contributing to general education country-wide.

After a brief introduction to the BSc. and MA courses, leading to the diploma for prospective teachers of geography, both branches of our above activities are described. The four courses directly related to the climate change are briefly characterised. As concerns the Public Education, we mention the extension of the GEOGRAPHY nEtQUIPMENT by climate of the Past, Present and Future and by the steps of the response by the society. We also report a study material for pupils of primary and secondary schools. The paper is terminated by sketching the perspectives being opened in distribution of knowledge and related behaviour patterns knowledge after the on-site digital satellite reception in Eger starting in the middle of the year 2010.

2. Studies for prospective teachers of geography

2.1. Diploma geographer (BSc)

The aim of training diploma geographers is to prepare them be able to widen their knowledge independently, in possession of a state-of-the art scientific approach and command of language. They acquire the theoretical and methodological bases necessary to understand our natural, societal, economical and settlement environment. They obtain knowledge on functioning of the environment, the natural and socio-economic neighbourhood, too. Our students choose from among the area-, settlement- and regional development specialization (academic specialisation with the perspective of continuing at the MSc level) and teacher specialisation (continuing at the MA level to become teacher of geography). General field-practice in physical geography are incorporated into the curriculum in 30 hours in the middle of their three years studies and also general field practice in social geography in 30 hours at the end of the studies. Those, who finished the area-, settlement- and regional development specialisation, obtain complex theoretical cognitions and wide practical experiences, as well. In this way, our students become experts with real regional view and motivation, based on true regional identity. They will be able to comprehensively approach the various departmental problems, targeting the possibilities of the solution with holistic view.

2.2. Teacher of geography (MA)

On teacher programme, based on BSc. of the training system consisting of periods:
In the case of aiming to obtain two parallel teacher qualifications: 150 credit-points (80 credits of professional cognitions + 40 credits of pedagogical and psychological cognitions + 30 credits of school practice). Basic programmes, cognition criteria and credit values, accepted as antecedent training: a.) Basic programmes accepted without further condition: BSc. in geography, BSc. in earth sciences, resp. their specialisations; b.) Basic programmes accepted with further condition and their credit requirements: 10 credits of pedagogical and psychological preparatory module (BA/BSc) before entering the MA course. In case of aiming to obtain a second teacher diploma, finishing the basic (BSc) disciplinary module of the given subject with 50 credit-points.

Preparation to fulfil educational research, planning and developing tasks in education, training for profession and adult tuition, based on certificate and knowledge obtained in the BSc programme, or in other forms of higher education, as well, as to continue the learning in the form of PhD studies.

3. Climate change in basic- and master-level education

Climate change can be tackled in four different topics during the 3-year basic education of diploma geographers and also 1-2.5 year education of master degree for being teacher of geography. In addition the very long term changes treated by various geological courses (where the changes are often much larger) and also Geo-statistics and geographical calculations where there are climate related examples to support the key operations in statistics. The above mentioned four topics are equally distributed among the Basic and Master courses, as follows:

3.1. Meteorology and climatology (BSc, 1st year)

"Meteorology is physics of the atmosphere" we were learning and teaching it even a few decades ago. But, since then it became clear that chemical composition of the air is also changing and fluctuating. So, speaking either about state variables of the atmosphere or tasks of meteorology, one should consider the composition of the atmosphere, together with the (thermo-) dynamic variables.

By using both meteorology and climatology in the name of this introductory course does not reflect our intention to put our vote to such a classification of sciences. It has a rather practical reason, since there are so many interesting and useful sources in both topics that this may explain the separation, itself. So, materials and referring homepages about the *weather*, i.e. on definite sequence of the atmospheric states for shorter period of time are arranges into Meteorology. Those questions in which these states correspond to longer period of time, with no special emphasis on their sequence, but treated as statistical ensembles, i.e. to *climate*, we sorted into Climatology.

3.2. Renewable energy sources (BSc, 2nd year)

This topic became obligatory for everyone just recently. This is not about climate change though it is related to it, since mitigation of the changes requires low carbon energy sources. This is the subject where various alternatives of saving energy and of applying renewable energy sources can be presented for the students. It is also a key issue to clarify the relation and sometimes difference between renewable, potentially renewable and carbon-free sources of energy.

Renewable sources exhibit good chance to be really carbon free and environment friendly from many other aspects, but they are still not synonyms of each other. The subject also deals with the opposite direction of the interaction i.e. with the question how the climate change affects the potential renewable energy sources. For the BSc. this is the last subject to remind the climate change, hence here some other economical and societal aspects of climate change are also tackled.

3.3. The atmosphere as a risk and resource (MA, 1st year)

Three years after and one level above the basic course on meteorology and climatology here we extend and select the topics of actual and long-term states of the atmosphere for the society according to the two aspects in the title. Climate change is a more or less known topic here, though in the process of transition to the Bologna system there are many students who have not heard about the topic. Hence in the first 1-2 years we must repeat these pieces of knowledge, but together with increasing the knowledge of the students on the atmospheric objects and processes to a higher level. The topic is grouped into three main sections:

1. Atmospheric motion systems, their characteristic space and time scales.

2. The atmosphere as a resource, e.g. for the water resources, natural and managed vegetation, transport, construction and human life.

3. The atmosphere as a source of various risks. Types of risks related to the physical state of the atmosphere in descending order of their space and time scales.

3.4. Climate change, impacts and responses (MA, 2nd year)

Climate of the earth has never been constant in the recent 5 billion years. The shorter or longer time changes and fluctuations lead to changes in state of the geographical skin, or, with its more recent and frequent name, the environment. i.e. a fourth sub-chapter, besides the existing three ones, i.e. past, present and future climates. The content of the course in more details:

Natural and anthropogenic factors of climate change. Milestones in recognition of the anthropogenic climate change. Changes in composition of the atmosphere: greenhouse gases, aerosol particles, ozone. Further anthropogenic forcing factors. *Empirical evidences of the climate change.* Components of the climate system, its forced and free variability. Space and time scales of the changes. Comparison of the speed of these changes with those in the distant past. Evidences of the human origin of the changes. *Global and regional climate scenaria.* Greenhouse-gas emission scenaria. The global climate models. Tools of climate projections, sources of uncertainty. Forecasts the global mean temperature: ice age, or monotonous warming? Projecting the regional features of climate change. Tendencies in meteorological extremes in Hungary and other regions of the World.

Impacts on natural ecosystems. Sensitivity and vulnerability. Effects of the expected changes on the sea-level and the sea-ice extent. Sea-shore systems and low laying areas. Effects on fresh water resources Changes in productivity and quality of living ecosystems due to climate changes. Changes in food and fibre resource availability, and in forest development. *Effects on human beings and their settlements.* Effects of selected industrial activities, settlements and climate and society of the cities. Direct effects on human health. Highlighted effects and vulnerabilities in Hungary, Europe and in the other continents. Cross-cutting issues with other environmental problems.

Industrial and public emission. Components of the greenhouse gas emission of the World in the various economical sectors and geographical regions. Long-term sources of the energy production and possibilities to reduce the emission. Emission reduction possibilities of transportation. Possibilities of living houses, public buildings and industrial complexes.

Emission of the agriculture, strengthening the ecological sinks of the greenhouse gases. Agriculture and forestry, as sources and sinks of CO_2. Modernisation of the waste management. Geo-political considerations and constraints. Potential geo-engineering possibilities. Role of the individuals in climate protection. Mitigation and adaptation.

4. Connections to the Public Education

In preparation of the above tasks from among the education subjects the geography undertakes the largest role. In the following we outline that for school education in the following ones and inside this, for the geography teaching into the system of which more general pedagogic aims is needed to embed. For that our plan which is already tried in demonstration school as trial and the gained experiences of this, later other schools make use of it, we have to be in consideration of this wider target system. As the extent standing of this provision is limited, here we speak about only two activities helping the education.

4.1. Extension of the „GEOGRAPHY nEtQUIPMENT" by climate related topics

The „ *GEOGRAPHY nEtQUIPMENT"* is a multimedia, internet service provided by the given homepage (*http://netszkozkeszlet.ektf.hu*; *http://netquip.ektf.hu).* The use of this tool is free of charge after registration. Entering to the site, the user goes into a virtual workroom in which clicking on the various pieces of furniture the user can get the requested education device. This homepage helps the work of teachers of geography and future teachers (Pajtókné Tari, 2006). The content is based on the National Basic Curriculum and also on the Schedule's Disposals. It contains every educational tool, what one can use during the preparation to the class. The *„GEOGRAPHY nEtQUIPMENT*" contains mainly demonstrative tools used by teachers, but switching to the links we can find any other sources e.g. the native school-net, the SULINET, or English links. In this way the independent learning becomes possible for the students. For more information on the study-tool see Pajtók-Tari (2010).

4.2. Methodology tools used outside of class

The other way to help the common education is the representation of the information belonging to climate change and life change, for which we gained the sponsorship of Foundation Pro Renovanda Culture Hungariae. The aim of this project is to assemble, test and publish two connected tools for education, which help the students in the primary and secondary schools to learn more about the climate change, to elaborate the environmentally

aware behaviour and also the rational behaviour to be attested on the time of the meteorological extremes at the same time. This aim is accomplished by four teachers of the College, and the tools are tried by the secondary grammar school in Eger. The program, i.e. the under-mentioned three main content elements, consists of a device from educational content, one motivating unit for the pupils and a prepared knowledge indicator. During this program a new program package (educational module) is prepared, which is can be figured flexible according to the local demand and possibilities (within the 5-10th classes). According to our intention, we would like to use it not only in a traditional way of the education, but also as a tool among the epochal education, project weeks, facultative lessons, or in the frame of forest schools. The content elements are the scientific concerns of the climate change; the reduction of the greenhouse gas emission, or in wider scope, concerning those opportunities which can be accomplished locally; and to the changes and the agendas of national adaptation.

5. Conclusion

In the above Sections we tried to demonstrate how meteorological facts, together with Internet-based- and traditional efforts to introduce climate-related knowledge and attitudes into the curricula, could increase the interest of present students and prospective teachers towards this set of questions as a part of sustainable development. Besides that the on-site satellite reception, starting this autumn in our Department, may provide new equipment in teaching further aspects of our climate.

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