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Introduction

Environmental Protection and Sustainable Development as a Contemporary Educational Priority

The phenomena of information noise and information overproduction relate to many contemporary civilization challenges, including the realization of the idea of sustainable development. Continuous education in the area of solving environment protection and human health problems seems to be one of the priority tasks of the didactics of biology.

Volume I of the Annals touched upon the topics related to didactics of biology in the context of its shifts as a pedagogy subdiscipline and a subject of the Nature Studies. Volume II covered the issue of educational models in the area of biodiversity promotion. Volume III, in turn, focused on "health literacy" – knowledge and skills every member of the knowledge-based society should possess on the topic of health.

The challenges the contemporary schools on all educational levels have to face revolve upon the interdisciplinary approach to environmental protection, and in the wider meaning, sustainable development. It is a difficult and complex task, because of the fact that currently the actions taken by schools, from primary school to an university, are too slow in comparison to social changes and needs regarding the environmental problem solving. Climate changes, ecological catastrophes, atmosphere pollution or modern-age diseases are crises the contemporary world has to face. The human anthropogenic activity contributes to the disadvantageous changes in the natural environment. This is why appropriate education plays an incredibly important role in the shaping of a proper life style and acting towards environment protection. More and more attention to the issues of global and local actions of the society on sustainable environment is being paid by governments, governmental and non-governmental organizations and scientists of many countries.

Environment protection is a multidisciplinary subject from the border of a number of scientific areas, which becomes more and more important in the sphere of social responsibility for the coexistence of man and nature. Educational negligence in the area of promoting respect to natural environment and media actions towards promoting consumptionism result in the contemporary civilisation life style not always being in accordance with taking care of nature, and the environment protection

awareness is too low to take any actions towards counteracting the natural resources degradation. This is why it is so important to educate specialists in the environment area and prepare students of both future teachers and decision-makers to properly include environmental protection into the educational process and understand the essence of managing the environment. It is also important to work towards the safety in terms of "global education," which can be achieved through proper educational work on the local and national scale, e.g. through promoting innovative interdisciplinary research and educational projects undertaken in cooperation with specialists and institutions of different areas of science. These actions should include the issue of the environment in the cultural, economic, political, democratic and technological approach in the international context. The results achieved on the basis of this cooperation can contribute to implementing new teaching strategies for environmental protection. Exchanging experiences, test results and formulated materials is a chance for teachers, educators and also students to start increasing the capabilities, range and quality of environmental education. Teaching about the environment should be connected with the understanding of the needs of specific people, stimulating solidarity in the range of economic, ethical, political and cultural actions and raising the sense of co-responsibility for improving the environment.

A reflection on the function of formal education in promoting the rules of sustainable development should include the multiplicity of education goals and the readiness of students and teachers to cooperate in this aspect. Helping schools implement good practices on the environmental protection should be supported by the municipalities and local societies. The actions programme of the local government should be based on promoting the knowledge-deepening process on environmental protection, as well as organizing the initiatives engaging the society of a given region to actively improve the state of the surrounding environment and increase pro-ecological awareness, and thus take effective actions in the region.

The dynamics and complexity of the environment as a place where a man lives requires considering it in the scope of multidimensional education open to the society's needs. Shaping the right attitudes and opinions towards the pro-ecological actions should be permanently implemented in the school and university curricula and understood as a list of teaching and learning goals. Implementing new content regarding the scientific advances in the field of sustainable development in the formal education should be correlated with the promotion of the upbringing towards the respect for nature protection laws. Only the right motivation of the members of the society to implement the environment protection knowledge, take actions in this regard and use the proper system of values in the environment protection aspect can influence the global problem of environment pollution, respect the law in this regard and creatively solve the worldwide problems of sustainable development. Learning the practical competences in understanding and integrating the actions towards shaping the pro-environmental attitudes and supporting the initiatives on the notion of being responsible for the future of the world in the difficult reality of

today can be facilitated by modernizing the educational process and filling the gaps in the students' knowledge structure regarding the issue of environment protection.

The special educational role in teaching about the environment is being played by the media as means of non-formal education. Through this the society can receive information on the advantages resulting from the latest genetic and technological studies about biodiversity, as well as use them in a balanced management of natural resources. Monitoring the protected areas, developing strategies and programmes of maintaining biodiversity and information on the international cooperation in this area should reach as many people as possible. A very important role in forwarding the right patterns of nature education is being attributed to the organization and coordination of an information network on the international arena through the integration of environmental, artistic, economic and social science knowledge. A good way to understand the environmental problems and analyze the social behaviours in this regard is the popularizational activity of the university. The constant decline of the environment quality, social and economic problems and inappropriate behaviour of people in the aspect of nature protection require higher schools to strongly influence the knowledge and the shaping of the system of values of students in the area of increasing the environmental awareness and motivate them to solve local problems of sustainable development. The constant development of the society, both economically and technologically, creates the need for the higher education institutions to look for ways of realizing the goals of environmental protection and to create methods that make society aware of the need to responsibly deal with environmental challenges of the modern world.

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The Role of Academic Integration in Education on Environmental Protection and the Concept of the Entrepreneurial University

Introduction

The problem of activation and integration of the academic world around the "environmental protection studies" (European equivalent: "environmental science education") was particularly important in the early 1990s, due to the then initiated socio-political changes and the associated higher education reform. In those days the changes were determined by the *Law on Higher Education of September 12, 1990* (Journal of Laws No. 65, item. 385), the main provisions of which were academic freedom, institutional autonomy, possibility to create non-public higher education institutions and charge fees for selected types of studies, and establishment of the Council for Higher Education. The Council was an advisory body to the Minister. It was elected by the academic community, and it determined curriculum standards for courses of study. Since 2005, the Council for Higher Education (RGSzW[1]) was in force and the State Accreditation Committee (PKA)[2] as well as the Rectors' Conferences were established under the new *Higher Education Law* (Journal of Laws 2012, item 572 as amended). The new *Higher Education Law* also introduced the possibility to establish the so called "adjective universities" – legal consortia of different universities, convents and social councils, and interdisciplinary education. This new approach, so important in the case of environmental protection studies which were placed on the list of majors in 1991, received the legal basis for its fully interdisciplinary character only under the Regulation of the Minister of 2011 on the learning area outcomes[3]. The earlier educational standards, effective for the "rigid

[1] Since 2009 Rada Główna Nauki i Szkolnictwa Wyższego [Main Council for Science and Higher Education].

[2] Since 2011 Polska Komisja Akredytacyjna [Polish Accreditation Commission].

[3] Regulation of the Minister of Science and Higher Education of November 2nd, 2011 on the National Qualifications Framework for Higher Education (Journal of Laws no. 253, item 1520).

list of ministerial study programs", did not, in fact, inspire development of original inter-area study programs.

According to Leja (2011), both the national legislation (after 1989) and the previous periods before as well as after the Second World War, reflect a distinct influence of the German liberal university concept. Humboldt's idea of the liberal university (the University of the Liberal Nation-State) means a commitment to the academic tradition, as well as research financed and controlled by the state, while preserving the academic freedom and the *de facto* weak relationships with economic needs of the society. It is reflected in the university of research, commonly known as the metaphorical "ivory tower", its main mission of it being research combined with education. The current *Law on Higher Education* implies solutions which, on the one hand, are consistent with the concept of the university respecting the liberal tradition, and on the other with the implementation of the innovative concept, the so-called entrepreneurial university (Clark 1998). Its activity, which emerged in the 1990s, is market-oriented (van Vught 1999). These changes were somehow enforced by the new processes which started on the boundary of the twentieth and twenty-first century, such as globalization, mass education, mobility and emergence of extra-university interdisciplinary research centres of network structure (Jabłecka 2002). The idea of entrepreneurial university comes from a more general theory of management. Drucker's (1992) view that public utility institutions, including universities, should be enterprising and innovative, and just like any company they should have a clear mission, a strategy and see change as an opportunity and not a threat, is significant in this context.

Environmental protection as a new study program fits the idea of entrepreneurial rather than liberal university. This is because, in essence, the basic characteristic of interdisciplinarity is breaking down barriers between the sciences and disciplines, and thus it requires an intensive and regular teaching staff cooperation, both within and between universities and between the university and the socio-economic environment. Although the importance of interdisciplinary education and collaboration is considered at the level of university mission and strategy, in practice the traditional organizational structures inhibit the growth and promote atomization of science and education. In this context, academic integration becomes particularly important in education within environmental protection.

The purpose of this article is to present the forms and effects of academic integration from the perspective of the entrepreneurial university idea and of the twenty years of functioning of environmental protection education. The main questions to be answered are: what is interdisciplinarity in relation to "environmental protection" and how to manage it? What is the simplest way to grasp the difference between multi- and interdisciplinarity? Where are we after 20 years, considering the goals of education, the structure of degree programs and the academic units?

Forms of integration

Academic integration around the environmental protection education took the form of annual national methodological conferences called "Protecting the environment for university science studies" (Wrocław, 1993, 2003, 2013; Cracow, 1994, 2004; Opole 1995, 2007; Warsaw, 1996, 2006, 2011; Poznań 1997, 2005; Gdańsk, 1998, Lublin, 1999, Toruń, 2000, Łódź, 2001, Olsztyn, 2002; Białystok, 2008; Zielona Góra, 2009, Katowice, 2010, Kielce 2012, Rzeszów 2014). The meetings gathered teaching and managing staff of many universities (Kantowicz and Lonc 2012). It is noteworthy that in 2002-2007 the study program was carried out in as many as 16 universities, 10 polytechnics, seven agricultural and two pedagogical schools, several state schools of higher vocational education and nine private schools (Olaczek and Babska, 2005).

In response to the question posed after twenty years of experience: what have we achieved regarding education programs and formal conditions of "environmental protection" as a field/discipline, first of all it is worth emphasizing the modern interdisciplinary training programs and the development of education of the teaching staff (PhD programs) as a result of the inclusion of "environmental protection" in the list of disciplines.

Education programs and integration

The positive role of integration of academic staff was most pronouncedly marked by the development of the curriculum and culture of education quality (Lonc and Kantowicz 2013) in a variety of study programs of "environmental protection". A major role was played by the international co-operation and integration of the Polish universities in the European network of ESSENCE[4] and Audes (Association of University Departments of Environmental Sciences in Europe) and the participation of staff involved in the organization and development of programs of the university environmental protection study (including the authors of the article) in the discussions at the European level. The participation in national and international meetings ensured the comparability of education programs with those of other European universities (Kantowicz, Lonc 2012).

Undoubtedly, the development of the so-called core curricula was a success; the curricula defined the methods and contents of environmental education: the requirements for the duration of the study, the total number and allocated time per course and teaching/learning method, for example lecture, supervised internship, group assignments such as workshops, projects, field work, individual assignments including thesis, self study, unsupervised internships and field work, etc. The

[4] ESSENCE (Thematic Network for Environmental Sciences): Network coordinator – Peter Maarleveld. Association of Dutch Universities – VSNU; Warsaw University coordinator – Ewelina Kantowicz – Inter-faculty Study of Environmental Protection, Warsaw University; Wrocław University coordinator – Elżbieta Lonc.

number of classes and thematic requirements (list of items) included not more than half of the total number of hours (including vocational training outside the university). In the first phase of the methodological discussions a multidisciplinary program of study was developed and it became the prototype of the ministerial standards. It is worth noting that these standards were developed during the annual national methodological conferences and then approved by the University Accreditation Commission (UKA)[5], along with the evaluation teams proposed by the environment. In the second phase the members of these teams, as experts, took an active part in the development of ministerial educational standards which had been introduced by the Regulation of the Minister of National Education and Sport of April 18th 2002[6], and then educational standards for two-stage studies within environmental protection, introduced by the *Regulation of the Minister of Science and Higher Education* in 2007[7]. These standards became the basis for the activity of the Polish Accreditation Commission[8] established in 2002. Its facilities in the field of environmental protection were still the annual national methodological conferences, which in recent years became engaged in the development of a subject area learning outcomes in terms of knowledge, skills and social skills which should be acquired by the students of environmental protection, as well as verification tools and procedures at all stages and forms of education.

Representatives of the Conference took an active part in the work of the National Qualifications Framework for Higher Education (KRK)[9], participating in the

[5] University Accreditation Commission (UKA) was established on January 31st 1998 under the earlier agreement of several Polish universities (www.uka.amu.pl). The participants of the first work on the standards of environmental protection were: J. Bolałek, E. Kantowicz, E. Lonc, J. Rayss, J. Siepak. Submission to the assessment of the study program by the UKA is voluntary but a fee is charged.

[6] Regulation of the Minister of National Education and Sport of April 18th 2002 on the educational standards for particular study programs and levels of education (Journal of Laws, no. 116, item 1004: annex 43: Educational standards for environmental protection, masters' studies).

[7] Regulation of the Minister of Science and Higher Education of July 12th 2007 on the educational standards for particular study programs and levels of education, the procedure of their establishing and the conditions to be met by universities in order to run interdisciplinary study programs and macro-programs. Annex 74: Educational standards for environmental protection, A. First degree studies, B. Second degree studies (www.bip.gov.pl).

[8] Polish Accreditation Commission (www.pka.edu.pl) was established under the name State Accreditation Commission on January 1st 2002, by the decision no. 54 of the Minister of National Education and Sport of December 28th 2001 on the establishment of the State Accreditation Commission. The Commission gained its present name under the Law of March 18th 2011 on the change of the Law of higher education, Law of scientific degrees and scientific titles and on the degrees and titles within arts, and on the changes in some other laws. Obtaining the PKA's accreditation is a prerequisite of running a study program.

[9] Regulation of the Minister of Science and Higher Education of November 2nd 2011 on the national qualifications framework for higher education (Journal of Laws, no. 253, item 1520).

project, co-funded by the EU under the European Social Fund. The results included the proposals of the learning outcomes for the natural history and agricultural areas of study, prepared at the Ministry of Science and Higher Education (Chmielecka ed. 2010). They have become the *de facto* new method of shaping curricula of environmental protection, indicating the possibilities and tasks of universities and increasing their autonomy (Kraśniewski 2011).

Interdisciplinarity and integration

The leading theme of the post-conference titles and monographic publications, which to this day is still the subject of much debate and controversy, appearing also during all the subsequent conferences, both foreign and domestic, was the problem of multi- and interdisciplinary environmental protection education - a comprehensive, general program of studies surpassing the boundaries of one faculty (Kantowicz 1994, 1996; Olaczek 2003).

The ultimately adopted meaning of multidisciplinarity was a summation of fragments of different disciplines, and of interdisciplinarity – a synthesis of the knowledge, methods and skills of different disciplines around practical solutions for environmental problems (De Grott 1992; Lonc 1993). Therefore, environmental protection is understood as a field of knowledge which requires a wide academic and research foundation, allowing understanding of both natural mechanisms and processes, and the place and role of man interfering in this system. Practical actions taken within environment protection, namely solving complex environmental problems to ensure sustainable development of societies, create the demand for such education (Lonc and Kantowicz 2004). The status and prospects of environmental protection education at different Polish and European universities were also presented at the conferences. As a result, the interdisciplinary environmental protection was defined in the context of integration of research and education, as well as in the form of practical activities taking place in the field, such as field courses or internships in business and administration enterprises.

Now, in the second decade of the twenty-first century, the learning outcomes formulated on the basis of the National Qualifications Frameworks are usually defined in two educational areas – natural sciences and agriculture. The associated questions are still similar to those posed during the discussions in the first and second half of the 1990s. At that time the urgent need to create a formal scientific field called "Environmental Sciences (Environmental Science)" was repeatedly stressed. The culmination of the lively discussion was a letter written during the Fifth National Methodological Conference organized in 1997 at the Adam Mickiewicz University in Poznań. It was part of the Application to the Central Committee for Scientific Titles and Degrees (letter dated 17th July 1997, prof. dr. hab. Jerzy Siepak, president of the University Coordinators for Environmental Protection Studies; members: professors Adam Juszkiewicz, Ewelina Kantowicz, Elżbieta Lonc and Romuald Olaczek) on the inclusion of environmental protection in the *Schedule*

fields of science and art and scientific and artistic disciplines, within which scientific degrees can be conferred (Polish Monitor No. 16, item 123 of 25 February 1992). Our attempts at giving environmental sciences status of a separate field, despite obtaining full support of the main universities (Kantowicz, Lonc, Wojnowska-Baryła 2005), failed. At that time the bureau of the Central Committee was against introducing provisional changes, recognizing the need for a wider-ranging reconstruction.

These debates were later conducted in the context of education of the teaching staff (PhD studies) and the related right to confer a doctor's degree in an interdisciplinary field, rather than within the disciplines (Kantowicz, Roge-Wiśniewska, eds. 2006). In 2007, the Centre for Environmental Studies, University of Warsaw (UCBS), organized the conference entitled "Environmental Protection – time for emancipation – a study program, a discipline, or a field of science?". It was attended by representatives of nine academic centres, the Ministry of Science and Higher Education, consulting organizations and students (Kalinowska and Lenart 2007). As a result of the increasing academic and social pressure, efforts of the Chairman of the University Coordinators for Environmental Protection Studies (prof. dr. hab. Jerzy Bolałek) which started once again during the National Methodological Conference organized in 2010, concluded in partial success. In 2011, "environmental protection" was entered as yet another discipline within the field of biological sciences and chemical sciences; agricultural sciences added "protection" to "shaping the environment", and technical sciences to "environmental engineering"[10]. During the last, twentieth, Conference in Wroclaw, a proposal for the inclusion of environmental disciplines, this time within the field of earth sciences, was adopted. It can be expected that in the next few years similar attempts will be made by representatives of other disciplines.

The above story highlights the paradox of confronting theory with practice. The commonly accepted meaning of the interdisciplinary nature of environmental protection, developed in the course of the twenty years of collaboration of the academic community, proved to be counterproductive. As a result of placing it in several scientific fields, the discipline "environmental protection" shows persistent "atomization of science", appropriate for the traditional concept of a liberal university. There is also a manifestation of constantly insufficient propagation of the innovative concept of entrepreneurial university, whose attribute is to create new structures, both within the university and in formal schemes of division of science. According to Clark (1998), there are five fundamental characteristics of the entrepreneurial university: strengthening of the management centre, development of peripheral segments, diversification of funding sources, stimulation of the academic core and the integrated culture of enterprise. Expanded developmental periphery requires, among others, overcoming of the tendency to maintain the

[10] Regulation of the Minister of Science and Higher Education of November 2nd 2011 on the areas of knowledge, branches of science and scientific and artistic disciplines (Journal of Laws, no. 179, item 1065).

subject area coverage as rigid departmental structures which exists in Humboldt's liberal university tradition.

Managing interdisciplinarity

Note that the above findings underline the validity of opinions expressed at the onset: about the environmental protection objectives and characteristics fitting within the entrepreneurial rather than liberal university. Among them, both the assessment of strengths and weaknesses of the functioning of environmental protection study programs carried out by the PKA members (Bielecki and Lonc 2007), and the experience of the authors in the past twenty years, indicate a great importance of the way of managing the interdisciplinary studies program. Let us take a closer look at the mentioned cases of founding separate units which run the environmental protection study programs.

The University of Warsaw was probably the first example of the "expanded developmental periphery" in the form of founding of a number of such units, among them the Centre for Environmental Studies, University of Warsaw (now Centre for Environmental Studies and Sustainable Development – UCBS, UW) and the Inter-Faculty Studies in Environmental Protection (MSOS, UW). This required changes in the articles of the *University of Warsaw Statute*, and then in the Rules and Regulations of the newly created organizational units. The changes in the formal and legal regulations were followed by changes in the allocation of ministerial subsidy between these units on a par with the faculties. The relative financial independence of both units and their direct subordination to the Rector of the University of Warsaw, as well as the close cooperation with the UCBS – MSOS Scientific Council, ensured the balance of various disciplines in the decisions taken regarding the organization of interdisciplinary studies (Kantowicz 1997). It should be noted, however, that this form of management is an exception rather than a rule. In most universities "environmental protection" remained part of faculties, usually chemical or biological. Hence, in the opinion of the PKA (Górniak 2012), the curriculum of environmental protection, depending on the leading organizational unit, reflects adverse effects of "overestimation of chemistry or underestimation of biology", that is unbalanced proportion of the basic disciplines in the structure and contents of education. This is due to the inadequate selection of the minimum staff composition, whose representatives usually focus on the field (discipline) which is appropriate for their organizational unit.

The so-called inter-faculty teaching boards are, to some extent, warrants of interdisciplinary education. These opinion-forming bodies provide a forum for the integration of environmental protection study program with the socio-economic environment, which manifests itself in consecutive years as an increasing number of contacts with companies and local governments. Such boards, each with about a dozen members, with the participation of external stakeholders, function at the faculty environmental studies at the Jagiellonian University, the John Casimir

University in Kielce, or the University of Wroclaw. At the University of Wroclaw, for example, the training within environmental protection is formally run by two units, the Faculty of Biological Sciences and the Faculty of Earth and Environmental Sciences. Because of the exclusively advisory character of the Program Board and the Director of the "Studium Ochrony Środowiska" [Environmental Protection Study] academic unit (example of expanded developmental periphery), all the program decisions are necessarily subject to approval by the councils of the two faculties, which certainly does not help the interdisciplinarity management.

Conclusions

The new legal situation in the second decade of the twenty-first century, which ceased to impose fields of study and training standards, and granted environmental protection the status of discipline in different areas, poses another challenge for the education in environmental protection, in particular its interdisciplinary character. Returning to the question which appeared in the early stages of the discussion – is unification of the curriculum the purpose of inter-university cooperation within environmental protection? – it can be stated that the standards in fact imposed some unification. Compulsory education contents standards in many fields and disciplines (natural sciences, social and medical) had a positive impact on strengthening of the interdisciplinary training programs. The standards, as we know, imposing only half-hourly size and number of credit points (ECTS), left room for the decision-making bodies to adjust the programs to the scientific and teaching potential of particular universities within environmental protection. According to the current KRK regulations, the autonomy of programs is far greater, which is a positive thing. At the same time, in a situation of granting environmental sciences the status of a discipline (and not a broad area) distributed among several areas provides an impulse to develop programs which are limited to a single field, such as chemical or biological sciences. Formed for over twenty years and aimed at training specialists competent in solving practical environmental problems, the interdisciplinary concept of environmental protection education may face barriers of development. The risk is even greater, since the traditional structure of university management is based on the organizational structure, in which departments frequently correspond to areas of the field, not disciplines. We see the opportunity for further development of environmental education in the propagation of the idea of entrepreneurial university and loosening of the rigid structures of university management.

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The Role of Academic Integration in Education on Environmental Protection and the Concept of the Entrepreneurial University

Abstract

The problem of activation and integration among university professors around the field of study named "environment protection" was particularly important in the early 90s of the last century due to the initiated socio-political changes and related higher education reform. The integration took on the nature of cyclical, annual national methodology conferences entitled "Protection of environment studies at the universities" (Wrocław, 1993, 2003, 2013, Cracow, 1994, 2004, Opole, 1995, 2007, Warsaw, 1996, 2006, 2011, Poznań, 1997, 2005, Gdańsk, 1998, Lublin, 1999, Toruń, 2000, Johannesburg, 2001, Olsztyn, 2002, Białystok, 2008, Zielona Góra, 2009, Katowice, 2010, Kielce, 2012). The new interdisciplinary field of study, entered on the ministerial list of courses in 1992, did not have a corresponding research discipline or relation to the tradition of education. The conference has become an important forum for the exchange of experiences and common understanding. The leading theme, which to this day is the subject of much debate and controversy, both at home and abroad, was the problem of multi- and interdisciplinary environment study, the course which is at the crossroads of many scientific areas. After twenty years of experiences, we ask the question, what we have achieved in the formulated goals of education, the structure of degree programs, developed teaching material, method and learning outcomes. The most important effects of the integration of domestic and international comparability of education programs are a relatively short period of implementation of ECTS, developing criteria and standards for the accreditation of UKA and PKA, the active participation of experts in accreditation procedures and the development of the area of learning outcomes. In practice, for those who manage it meant the ease of learning and the implementation of good academic practice.

The challenge of interdisciplinarity in environmental education is the creation of a new legal situation of "environmental protection" discipline in two areas: life sciences and

chemical sciences. This challenge can be summarized in the question: will the logic of further development be the loss of awareness of the need of interdisciplinary environmental protection? New challenges should act as an incentive to continue the tradition of regular meetings of the younger generation, who is responsible for the future of education in this increasingly important social field.

Key words: academic integration, education, environmental protection

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Education for Sustainable Development in the Academic Education in Poland in the Light of the Education for Sustainable Development Strategy

Introduction

On December 20, 2002, the General Assembly of the United Nations established the years 2005–2014 a UN Decade of Education for Sustainable Development, signalling that the time has come to initiate a substantial transformation of the education system. It became clear that the world community must make an effort to switch the education system to a completely new direction in order to meet the rapid changes and new challenges brought by the twenty-first century. The vision and objectives of the UN Decade clearly define a new paradigm of education based on values and a holistic approach towards the dependencies emerging at the junction of environment, economy and society – both at the local and global level.

The role of education as a catalyst for change toward a sustainable development was already emphasized 10 years earlier, in the international sustainable development policy paper, entitled Agenda 21, adopted by the UN during the conference in Rio de Janeiro. Among the necessary actions such as the protection of the atmosphere, strengthening the rights and role of women, change in consumption patterns or halting deforestation, it is education that is indicated as a tool necessary to achieve the objectives in each of the key areas. The words from Agenda 21: "new ways of investing in the future are needed in order to achieve global sustainable development in the twenty-first century. The scope of recommendations varies from new teaching methods to new methods of using raw materials and participating in the creation of a sustainable economy" (http://www.unesco.com), emphasize that the advancement of knowledge and awareness of all members of the society is the foundation on which you can build a sustainable world.

In response to the commitments made in the international arena, in 2005 in Vilnius, the European Economic Commission of the United Nations adopted a Strategy for Education for Sustainable Development as the European form of implementation of the objectives of the UN Decade (Borys 2010). The phrase justifying the need for the implementation of ESD to the education system has been included already

in the introduction: "Education, being one of the fundamental human rights is a prerequisite for achieving sustainable development. […] education for sustainable development can help the realization of our vision of the future." (Ministerstwo Środowiska 2008) The strategy contains a set of guidelines and recommendations on the scope of the implementation of ESD, the preferred methods of teaching, learning areas, values, competencies, materials and tools, and international cooperation. It also points out that "it is important to ensure that **all pupils and students** are able to acquire adequate knowledge on sustainable development [...]," (Ministerstwo Środowiska 2008) at the same time addressing the demands concerning the higher education system.

At the end of the UN Decade of Education for Sustainable Development, and almost ten years after the adoption of the Strategy for Education for Sustainable Development, it seems reasonable to ask the question, to what extent Poland has fulfilled its commitments regarding the ESD. In the face of rapidly occurring environmental, ideological and socio-economic changes, do the institutions of higher education and the entire academic community properly use their potential for active participation in implementing the international and national strategic documents? Are colleges and universities able to keep up the pace with contemporary social transformations when the azimuth of changes paves the way to sustainable development?

Higher education should significantly contribute to the ESD through the development of adequate knowledge and expertise (Ministerstwo Środowiska 2008), and its role in the education of future professionals is essential for achieving sustainable development in all areas of socio-economic development. The aim of this study is to verify whether the system of academic education in Poland is responsible for the commitments made at the international level in the field of education for sustainable development.

Regulations of national law concerning training in the field of education for sustainable development in the system of academic education

International documents – Agenda 21 or the Strategy for Education for Sustainable Development – require the signatories, including Poland, to include the ESD content into the curriculum at all levels and fields of formal education. The first step in the implementation of these commitments is the inclusion of the relevant provisions of national law in the documents.

The presence of the content in the field of education for sustainable development in the curriculum, from kindergarten through to secondary schools, is guaranteed by the Regulation of the Minister of Education, incorporating ESD

into the core curriculum for different types of schools[1]. On the other hand, in the case of universities, the obligation to maintain education in the field of sustainable development is applied by separate provisions under the Regulation of the Minister of Science and Higher Education of 2 November 2011 on the National Qualifications Framework for Higher Education[2]. The National Qualifications Framework requires students to acquire knowledge and skills in the field of sustainable development only in the case of education in the natural sciences, agriculture, forestry and veterinary medicine, in the course of the studies of I and II degree. Therefore, this obligation does not apply to social (including pedagogical), economic or technical sciences. This means that the National Qualifications Framework does not require the prospective teachers, economists or sociologists to possess knowledge of the concept of sustainable development, or the understanding of the interdisciplinary problems and issues that arise at the border of environment, economy and society.

It is worth noting that there are no guidelines concerning education for sustainable development for the III degree studies (doctoral), regardless of the discipline, leaving full autonomy in this regard for the students, making the presence of such the content dependant both on the initiative of the university authorities, as well as its competence and human resources.

It is difficult to say whether the fact that education for sustainable development has a low priority in the legislation regulating the sphere of higher education is the result of negligence, or rather insufficient knowledge and awareness of the law-makers. Only 43% of Polish citizens understand the concept of "sustainable development" in a way that applies equally to environmental, economic and social development issues. Given that ESD is mandatory only in the fields of natural sciences, one can formulate a hypothesis that perhaps, in the common awareness, the first and often the only association with the term "sustainable development" is still the issue of environmental protection.

The results of surveys[3] conducted among students including a breakdown between different types of schools, indicate that it is the higher education where activities are undertaken in accordance with the principles of sustainable development the rarest. These trends are also confirmed by a survey conducted among teachers – only university teachers (10%) indicated that their institution was not taking any action in accordance with the principles of sustainable development. The results presented above may suggest that it is the consequence of the lack of uniform guidelines in the field of ESD in higher education.

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[1] Rozporządzenie Ministra Edukacji Narodowej z dnia 27 sierpnia 2012 roku w sprawie podstawy programowej wychowania przedszkolnego oraz kształcenia ogólnego w poszczególnych typach szkół (J.L. 2012 item 977).

[2] Rozporządzenie Ministra Nauki i Szkolnictwa Wyższego z dnia 2 listopada 2011 roku w sprawie Krajowych Ram Kwalifikacji dla Szkolnictwa Wyższego (J.L. 2011 no. 253 item 1520).

[3] *Ekspertyza dotycząca edukacji dla zrównoważonego rozwoju w Polsce. Raport końcowy*, Poznań 2012.

Without a doubt, education for sustainable development is not a standard of academic education. The graduates interested in the development of this area of interest can take advantage of the offer of postgraduate studies. Many universities, in the context of postgraduate education offer specialized fields of study devoted to the issues of sustainable development, but it often happens that due to the lack of a sufficient number of students, such studies do are not launched.[4]

Education for sustainable development in the field of economics

Sustainable development is a very inclusive concept involving the issues of natural resources management, access to drinking water, poverty reduction, access to education, environmental protection, gender, ethnicity and religion based equality, patterns of production and consumption, ethics, democracy, governance, or the economy. In fact, the term covers almost all spheres of life, becoming the new paradigm of training and management. Due to the large variety of issues it is necessary to create holistic learning programs, at the same time relating to the key issues addressing the needs of particular professional groups (Lorek 2013).

In particular, it seems important to raise the awareness and sensitivity to the issues of sustainable development in people, who in the future will occupy positions related to the economy, management, planning and entrepreneurship, because the decisions made by them will have consequences in social and environmental terms. It is the students of economics who have the potential to constitute a management team, which has a decisive influence on the shaping of the national economy in a manner allowing the achievement of the objectives of sustainable development.

Despite the fact that education in the field of sustainable development is an obligatory component of graduate education exclusively in the faculties of natural sciences, agriculture, forestry and veterinary medicine, it happens that higher education institutions recognize the need to undertake measures to increase the knowledge and awareness of sustainable development among the students of economics. As examples of good practices in the integration of the ESD content into the curriculum, the following may be mentioned: a compulsory subject of "Ecological aspects of management" in the course of "Management and Marketing" at the Podlasie Academy, or the subject of "Fundamentals of sustainable development" taught in the past at the University of Economics in Katowice. Currently, the university proposes the specialty of "environment and space management" within the course of spatial development at the Faculty of Economics.

Studies concerning awareness and knowledge of sustainable development, conducted among the students of economic universities, indicate that the actions taken carry out the set objectives quite well. The surveys conducted at the University of Economics in Katowice show that from year to year the percentage of students who during their studies have encountered the concept of sustainable development

[4] *Ekspertyza dotycząca edukacji dla zrównoważonego rozwoju w Polsce. Raport końcowy*, Poznań 2012.

is increasing (90% of respondents in the academic year 2010/2011). What is more, up to 95% of the students has a good understanding of the concept of sustainable development by locating this subject at the intersection of the environment, economy and society, and 89% of the respondents admit that it is important to transfer the knowledge in the field of environmental considerations of the development within the context of education in the economics courses (Lorek 2010). These results are encouraging, however it should be remembered, that comprehensive education in the field of economics is not the norm.

The authors of a study on the knowledge of sustainable development of the students majoring in "Management and Marketing", conducted at the Podlasie Academy, reached quite different conclusions than those mentioned above (Otrębska et al. 2007). The authors, based on the results of surveys, formulated the thesis that the respondents do not look at the matters of nature conservation globally, but rather from their own perspective, focusing mainly on the issues that affect them directly. The fact that the respondents, taking part in this study, pointed to the green areas near their place of residence or actions to improve air quality as the preferred investment objective is not necessarily indicative (contrary to the authors) of the dominance of anthropocentric philosophy in the thinking of young people. Education for sustainable development is often carried out according to the rule "think globally, act locally," and local patriotism is also a part of this philosophy. In addition, respondents possessed a (virtually) small amount, so it seems more reasonable to devote it for feasible local objectives than, for example, for the protection of endangered species or improvement of water quality of the Baltic Sea, which requires an incomparably greater financial outlay. Further, the studies have confirmed that the well-being of nature is the value of high importance to the respondents, although the knowledge of students in the field of environmental protection, in the opinion of the authors of the study, is insufficient. It must be remembered that ESD in education puts more emphasis on the development of attitudes and values, than knowledge. Authors of the study relate to the level of preparation of future graduates of management and marketing to implement the principles of sustainable development in a critical way, while recognizing the need for the robust training of students. The fact that the curriculum includes the content related to the environmental aspects of business management deserves praise.

Education for sustainable development in the academic training programs for future teachers

"Appropriate initial training and further education of educators and the ability to share experiences are particularly important for ESD to succeed. Along with raising the awareness and knowledge relating to sustainable development, and in particular those aspects of sustainable development, which relate to areas related to their profession, educators can be more effective [...]" – these words in the Strategy for Education for Sustainable Development (Ministerstwo Środowiska

2008) signal the need to train teachers in the field of ESD. The strategy emphasizes that the training of teachers is a particularly important aspect of implementing the assumptions of education for sustainable development, because the education of students in the spirit of sustainable development will be their responsibility. This indisputable fact is, however, omitted in the documents setting out the requirements of the education of future teachers.

The requirements concerning the training of future teachers (Regulation of the Minister of Science and Higher Education of 17 January 2012 concerning the standards of education preparing for the teaching profession and the Regulation of the Minister of Science and Higher Education of 4 November 2011 on the model of learning outcomes) do not contain any guidance directly related to education for sustainable development. This means that educational institutions are not obliged to train future teachers in the field of sustainable development, despite the fact that, in professional practice, the core curriculum will oblige them to transfer content from the scope of ESD to the students. The possible consideration of the ESD content in the field of education for sustainable development in the curricula of teacher training programs depends entirely on the initiative and competence of the university, as well as human resources at its disposal.

Teacher education does not end with the completion of the relevant studies, but can be and often is continued in Teacher Training Centres. This results not only from the need for further development of competencies of the teachers themselves, but it is also a necessity arising from the desire to obtain further degrees of promotion. Who has time for environmental education? The report on the audit of environmental education within formal education prepared by the Centre for Environmental Action "Źródła" (*Ośrodek Działań Ekologicznych "Źródła"*) shows, however, that the educational offer of the teacher training centres in the field of education for sustainable development is modest - as many as 6 out of 21 analyzed centers during the period of study (the analysis concerned the offers for the school year 2010/2011) did not offer any form of training related to environmental education. At the same time, the results of surveys conducted among teachers indicate that over 80% of respondents are interested in various forms of training in the field of sustainable development and environmental education, which may suggest that the current educational offer does not meet the needs of educators (Wychowałek et al. 2011)

The results of studies on teachers' knowledge and awareness in the field of sustainable development seem to confirm the existence of certain shortcomings in the process of education of future teachers. As many as 31% of the teachers had never heard about the term "sustainable development", and only every fifth teacher declares a very good level of knowledge on the subject. Taking into account the division of respondents with respect to the place of employment, the greatest knowledge of the concept of "sustainable development" is represented by the teachers in primary and middle schools, the lowest – secondary schools. Every third

academic teacher has never encountered this concept, while 67% of teachers in the field of natural sciences declare a very good understanding of the meaning of the term.[5]

Further, in the context of the recommendations of the Strategy for Education for Sustainable Development, in addition to the substantive preparation of teachers to conduct education for sustainable development, it is equally important to prepare them methodologically. The strategy recommends and promotes the active methods of education, to stimulate the learners to independently seek solutions, shape attitudes and develop competences of critical thinking. Such educational outcomes may be the result of the application of discussions, simulation games, role plays (drama method), field activities, case studies, project method or communication and information technology (Ministerstwo Środowiska 2008). However, the survey of teachers shows that the most common method in environmental education is a lecture (a talk), recognized by teachers themselves as the least effective and least attractive to students. Much less frequently used are the methods recognized by the teachers themselves as the most effective and attractive for the students, e.g. educational games, discussions or the project method (Wychowałek et al. 2011). These results may suggest that in the future teacher training programs (including the system of supplementary education) it is necessary to increase the emphasis on working methods engaging the students.

In addition to the application of participatory methodologies, the key to realizing the goals of education are also the so-called soft competencies of a teacher. Among them, the attention is drawn to skills such as teamwork, effective communication or lifelong learning (Tuszyńska 2011). In the context of education for sustainable development, the important emphasis is put on the development of proper attitudes (respect, tolerance, sense of responsibility) and building the world of values. The ability to undertake dialogue and the communication skills of a teacher seem to be a key factor determining the didactic success, so the position that the development of these skills should be a priority in teacher education colleges seems reasonable.

An example of good practices in the area of skills of future teachers in the field of ESD was the preparation of the 45-hour "Educator of sustainable development" course by the Faculty of Biology and Earth Sciences at the University of Maria Curie-Skłodowska in Lublin, addressed to the students of biology. The course had an interdisciplinary character, which allowed participants to deepen their knowledge in various aspects of sustainable development. The effects of the course were measured by ex-ante and ex-post tests, which showed an increase of the participants' knowledge by 54.7%, which in the opinion of the authors indicates that the main objective of the course, and thus acquiring integrated knowledge on sustainable development has been achieved (Gajuś-Lankamer et al. 2011).

[5] *Ekspertyza dotycząca edukacji dla zrównoważonego rozwoju w Polsce. Raport końcowy.* ITTI Sp. z o.o. as per order by Ministerstwo Środowiska, Poznań 2012.

Measures in favour of education for sustainable development, adopted in higher education – good practices

Universities not only implement research and teaching programs, but they are also the place of undertaking other activities for education for sustainable development, unrelated to the educational program. In this section, I wish to draw attention to the examples of good practices for education on sustainable development, which in recent years have been initiated at Polish universities. It should be emphasized that the practices mentioned in this section, due to the voluntary nature and grassroots initiative should be classified rather as belonging to the area of non-formal education.

Important role in promoting the concept of sustainable development is played, among others, by the University Centre for Environmental Studies and Sustainable Development (University of Warsaw) offering a series of open lectures cantered around the issues of the year in each academic year, under the general title: "Selected issues of ecology and environmental protection. Sustainable development in theory and practice." For example, the theme of the lectures in the academic year 2013/2014 was: "Ideal City – sustainable city. Spatial planning of urban areas and its impact on reducing the effects of climate change." The activities of the Centre also include the proposals for seminars and training courses for teachers on how to conduct education for sustainable development. A series of one-day courses entitled: "How to conduct education for sustainable development", addressed to teachers, was realized in 2012 in the five provincial cities in cooperation with the Ministry of Environment and the regional teacher training centres.

An important function, from the point of view of raising the awareness of the academic community in the field of sustainable development is performed by student initiatives undertaken at the university . An example can be the project of the students of the Academy of Mining and Metallurgy in Krakow, implemented since 2007, under the banner of Green College, under which educational campaigns to promote environmentally friendly behaviours or healthy lifestyles are organized.

Since 2012, the Cracow universities are also the organizers and hosts of the Cracow Festival of Responsible Business - in 2014 the third edition of this event took place. The previous edition of the festival included the participation of: the Academy of Mining and Metallurgy, Jagiellonian University, Pedagogical University and University of Economics. During the festival, students have the opportunity to learn what the corporate social responsibility (CSR) is and why the strategy of sustainable development is increasingly being implemented in Polish enterprises. The leading topics of the last edition of the Cracow Festival of Responsible Business were among others: CSR and environmental protection, social aspect of CSR: CSR activities for human rights and education, CSR in the area of employment. With the participation of the invited guests – the practitioners of the implementation of CSR and the rules of sustainable development in various areas of the functioning of the organization, students have the opportunity not only to deepen their knowledge

in this field, but also realize the practical dimension of sustainable development. A major advantage of the project is the fact that the organization of the festival involves the participation of universities of different profiles of education – technical, pedagogical and economic, which creates an extra chance to perceive the aspects of sustainable development in the area preferred by the participant.

Within the walls of universities there are commonly also student scientific circles. Some of them focus the profile of their activities around sustainable development, which can be associated with the growing interest of students in the subject. Due to the fact that the theme of operation of student scientific circles concerning sustainable development has not been adequately studied, the actual scale and importance of this phenomenon are unknown.

The initiatives undertaken by NGOs for the improvement of knowledge and awareness of students and teachers in the field of sustainable development

We can say that the mission of NGOs is to fill certain gaps in education, health, nature conservation, helping the sick or excluded, or the humanitarian protection of animals. Sensitivity to social and environmental problems, their good knowledge and the search for solutions, and even the ability to exert pressure, make the non-governmental organizations an indispensable component of the social landscape of Poland. The role of the NGOs in the promotion and education for sustainable development is also not to be underestimated. Non-governmental organizations are actively working in the field of non-formal education, but increasingly they also constitute support within formal education and in the system of supplementary education of teachers.

One of the organizations with a key impact on the state of knowledge and awareness of students and teachers is the "Źródła" Centre for Environmental Action, functioning for 20 years, having its registered office in Łódź, but taking action nationwide. Interests of the Association are focused on environmental and ecological education, global, regional, civic and health-oriented education, and thus the broadly understood education for sustainable development. The support for teachers and students is the ability to: take part in stationary or e-learning training courses, use the ready-made lesson plans and teaching aids. The offer of the Association also includes interesting publications and reports on the state of education for sustainable development in Poland. Importantly, ODE "Źródła" actively promotes the engaging and creative ways of working with students, which are part of the foundation of the Strategy for Education for Sustainable Development. Among the implemented measures, these training courses deserve special attention: *School for Trainers for Environmental Education* or *Global Education for children* (a project aimed at pre-school and primary education teachers).

Many other non-governmental organizations make an effort to implement projects aimed at students or teachers, providing developments, methodical guides,

organizing training courses and seminars, developing lesson plans. Many of them are thematically focused on global education, in this way being involved in the topic of sustainable development. The group of organizations active in this field can include, among others, "Zagranica" Group, Centre for Civic Education, Our Earth Foundation, Responsible Business Forum, and the Polish Humanitarian Organization.

Conclusions and recommendations

Despite the many real advancements in education for sustainable development, there is still no comprehensive vision of such education at the level of higher education (Lorek 2010). The fact that at the ministerial level, despite the commitments made at the international level before nearly a decade, the need to oblige the universities to conduct compulsory education in the field of ESD still has not been recognized, is not without influence on the Polish system of higher education. Awareness and knowledge of students and teachers in the field of ESD is still not sufficient to say that the creation of the Strategy for Education for Sustainable Development has succeeded.

An important function in the academic education for sustainable development is fulfilled by student organizations and NGOs that are trying to fill the gaps in education. Their activity should not be an excuse for the lack of strategic, holistic and interdisciplinary program of education for sustainable development in academic education.

Universities should educate professionals in the field of environmental protection, as well as introduce elements of ESD to teacher training programs, economic, technical and human sciences. What is particularly important, from the perspective of achieving cascading effects, is directing the greatest efforts to the education of people who in the future will work in the teaching profession. This applies to both the academic education system and the forms of supplementary education offered by the Teacher Training Centres.

In accordance with the principle of autonomy of the universities, they have a lot of freedom in arranging their curricula (Markowska-Manista et al 2010), but they do not operate in a vacuum and cannot remain indifferent to the challenges of a dynamically changing world. Universities should not only use the test results for the creation of innovative paradigms of how the world works, but also actively contribute to the education of students and improving academic competence in the field of sustainable development, while seeking the opportunity to improve their competitiveness and the attractiveness of the market. The academic community can and should be a catalyst for positive change, contributing to the implementation of the vision of a sustainable, equitable world, which will provide a secure future for the future generations.

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Education for Sustainable Development in the Academic Education in Poland in the Light of the Education for Sustainable Development Strategy

Abstract

In the year 2005 in Vilnius The United Nations Economic Commission for Europe adopted the Strategy for Education for Sustainable Development. The Strategy obliges the signatory countries to integrate the education for sustainable development (ESD) into all forms of their education system and covers all levels and faculties. After nearly 10 years from its adoption

and at the end of the United Nations Decade of Education for Sustainable Development, it is reasonable to verify the engagement of Poland in fulfilling its commitments. The aim of this study is to identify the place of education for sustainable development in national regulations and to make an attempt to characterize the state of education for sustainable development in higher education, with particular emphasis put on economics and pedagogy.

Key words: education for sustainable development, sustainable development, strategy for education for sustainable development

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Environmental Education and the Development of Organic Farming – Experience of Poland and Ukraine

Poland and Ukraine are the two countries which in the course of their historical development overcame similar economic problems. However, the ways to resolve those problems were not always the same. Pursuing their own policy, these states at the turn of the twenty-first century reached different results. By now, Poland has acceded to the European Union and other international communities. Ukraine is still on the way to the EU membership, trying to promote and deepen the partnership with the European states. The immediate task facing Ukraine currently is to implement reforms in all sectors of production bringing the country's economy to international standards, introduce legal mechanisms and develop market economy.

Living in similar natural environment, Ukraine and Poland face a common problem of rational use of agricultural lands to reduce the negative impact of agriculture on the environment. From this perspective it would be quite interesting for Ukraine to study the experience of Poland in the development of organic farming or ecological agriculture. Having analyzed some legal documents of the Republic of Poland and the scientific papers of Polish scientists, we can assume that it is the result of the systematic state policy in the agricultural sector based on the formation of environmental education in agricultural universities in Poland.

According to the Polish scientist S. Wiąckowski, the most important values in the process of training are human dignity, respect for life and natural diversity, the right for freedom and peace, the opportunity of comprehensive human development and formation of personal responsibility (Wiąckowski 1997).

The obligatory realization of the following principles of environmental training at all educational levels is reflected in many state regulatory documents of Poland (Grodzińska-Jurczak 2004). In particular, it concerns agricultural universities, where environmental education should outrun practical needs (Kośmicki 2005).

This point is equally important for both Poland and Ukraine, where the chances to compete with the Western European model of intensive agriculture in the coming years are insignificant and undesirable in terms of biodiversity. Greater success can

be achieved by ecologically-oriented agricultural sector and production of organic foodstuffs, competitive on international markets. It should be emphasized that this alternative to traditional agricultural management requires that professional training of specialists in agricultural sector should be intensively focused on the principles of ecology as a science and formation of the system of knowledge about the development of crop growing technologies that stimulate adaptation of crop varieties to climatic changes and increasingly frequent drought conditions.

The above views enable us to examine the relationship between the development of organic farming in the country and the availability of environmental issues in the content of the main agricultural training programs in the higher educational institutions of Ukraine and Poland.

Poland is a country where the use of chemical inputs in agriculture has always been lower compared to other European countries, which resulted in the best biodiversity and environmental quality of agricultural products in Europe. As it is stated in the Polish normative documents, this fact encourages farmers in Poland to produce ecologically clean agricultural products and increase their volume on the European consumer market[1].

According to the works of the Polish researcher A. Strumińska-Doktór, organic farming is based on the following important principles:

- Improving soil fertility by introducing organic fertilizers (compost, green manure, animal waste) and crop rotation;
- Maintaining the biological activity of soils and their protection from erosion by using rows (no weeding between rows);
- Balance of crop and livestock production reflected in the economy as the balance of fodders and fertilizers;
- Use of proper fodder for feeding animals (exclusion of synthetic additives from the diet);
- Ensuring the housing conditions of animals appropriate for their breed;
- Sustaining biodiversity of domestic animals, cultivated plants and their wild relatives that are raised on the farm;
- Developing variety of agrobiocenoses (Strumińska-Doktór 2007).

It should be noted that the principles of organic farming are reflected in the training programs of all agricultural areas of higher education in Poland. Particular attention is paid to organic farming in the cycle of specific content modules of training programs.

We analyzed the curricula of the basic agricultural areas (agronomy and animal science) at Warsaw Agricultural University (SGGW), considered to be the leading natural and agricultural university in Poland. The analysis shows the increased focus on training future professionals of the agricultural sector to implement organic farming (table 1).

[1] Plan Działań dla Żywności Ekologicznej i Rolnictwa w Polsce na lata 2007–2013.

Tab. 1. The content modules with elements of organic farming in educational training programs for EQL "Bachelor" in selected areas at Warsaw Agricultural University (SGGW).

	Fields of Study	
	Agriculture	**Animal Sciences**
Course contents with elements of organic farming	– agroecology and environmental protection – animal breeding – plant growing – propaedeutics of organic farming – biological methods of agrophage destruction – organic crop production – natural use of sewage and waste – standardization of agricultural products – agrotourism	– ecology – livestock breeding – poultry – hygiene and prevention of animal diseases – pig raising – culture of a Polish village – a human in nature – "Natura 2000" program – agro-environmental programs – nature protection – animal keeping – environmental problems in pig and poultry raising – modern trends in using horses – livestock production in ecological farms – alternative technologies of livestock production – analysis of fodder

Source: Author's study

The content of the modules with the elements of organic agriculture can develop in future professionals the ability to understand organic farming as a form of agriculture that uses natural facilities providing long soil fertility and healthy animals and plants. This management system is based on the balanced crop growing and livestock production using natural materials. With the removal of pesticides and artificial fertilizers, organic farming does not cause contamination of soil and water, limiting leaching of nutrients and promotes the development of micro-organisms in soil, produces high quality food products that are appreciated by consumers.

Organic farming is the sector of agriculture which is characterized by the fastest pace of development, especially in Europe. Poland also tends to increase eco - friendly production. In the late 1990s there was a growing interest in this branch in Poland. Organic farming originated as a social movement. Then, the Ministry of Agriculture and Rural Development of the Republic of Poland (Ministerstwo Rolnictwa i Rozwoju Wsi RP) began developing regulations in this branch of agriculture. The government provided financial support to households in the form of subsidies per hectare of areas subject to organic farming.

In recent years there has been a dynamic development of organic farming in Poland. The state support for the industry creates opportunities for solving problems of food security, food quality assurance, environmental protection, animal health and rural development. Organic farming is important not only as a producer of foodstuff, it also affects the maintenance and even the increase in species diversity

of agrobiocenoses. The use of organic technologies in agricultural production is beneficial to the environment, as it does not cause pollution or degradation of natural areas.

Though the scientific principles of organic farming were developed over 40 years ago, Ukraine at present has not reached the level of Poland in this direction. In the early 1970s the Ukrainian scientist M. Shykula began the study of soil without the use of chemicals. Experiments were conducted on a collective farm named after Ordzhonikidze in Poltava region[2]. However, this way of management at that time contradicted the theories of industrial agriculture promoted by the government, and consequently, the positive results of the research did not receive large-scale development. Only at the end of the 1990s Ukraine resumed its interest in organic farms thanks to the scientific collaboration with ecological farms in Western Europe. According to the latest data, there are 72 ecological farms operating in Ukraine and covering about 240 hectares of organic production. In comparison, the number of farms in Poland exceeds 15,000 covering the area of over 300,000 hectares[3]. Hence, Ukraine has enormous industrial potential in the field of organic farming. Though the Ukrainian market of ecological agricultural products and the processing sector are relatively underdeveloped, the vast percentage of finished goods is exported.

We believe that the reason for such a situation is not only insufficient attention to environmental and agricultural policy by the state. The analysis of curricula and programs of the major agricultural fields of study in Ukrainian higher educational institutions also indicates that there are drawbacks in their content, insufficient number of specific disciplines that include elements of organic agriculture, ecological approach to agriculture, which ultimately do not contribute to the formation of environmentally conscious citizens and decision-makers in agricultural sphere. In our opinion, an important part of education that may solve the problem of environmental training in agricultural sector is the variable component of education. When analyzing this issue, we considered the observation of V. Kremin that standards should become a means of providing government guarantees of the quality of education at a fundamental level, and they should also ensure the maximum variation of the content and structure of training in order to ensure the operational change of priorities in the labour market (Kremin 2005).

Thus, the purpose of the variable component is to reflect historical, economic and legal impact of the specific branch of production on the environment and opportunities to prevent and eliminate its negative effect. The study on the aforementioned is subject to a certain algorithm:

1. In terms of its impact on the ecological systems, on air, land, water, forest and other resources, industry occupies the leading position among other branches.
2. Rational use of natural resources is an environmental component of production, through which natural resource potential involved in the economic circulation

[2] Organic farming, http://byshev.org/stati/organ-chne-zemlerobstvo.html.

[3] Rolnictwo ekologiczne po ukraińsku to: dużo i tanio, http://www.ewgt.com.pl.

affects the socio-economic system, ensures protection of the environment and creates the necessary conditions for the restoration of natural resources and life support.

3. Environmental management using resource-saving technologies is a powerful way to accelerate scientific and technological progress.
4. Implementation of measures for resource conservation, preventing ingress of contaminants into the environment, development and implementation of measures to protect certain objects of nature, development of measures to prevent emergencies aimed at ensuring environmental priority in all kinds of business.

Thus, the variable part of training programs for educational institutions creates opportunities to realize the objectives of environmental education by developing the content of elective courses. To compare the semantic content of the disciplines in the variable part of the training programs in the areas of agricultural universities in Ukraine and Poland through the prism of environmental education, we analyzed the description of variable (elective) disciplines in the curricula of National University of Life and Environmental Sciences of Ukraine in Kiev and Wrocław University of Environmental and Life Sciences (table 2).

Tab. 2. Comparison of optional subjects of the undergraduate studies Field of Agriculture at the Wroclaw University of Environmental and Life Sciences (Poland) and National University of Life and Environmental Sciences of Ukraine in Kiev (Ukraine)*

University of Environmental and Life Sciences in Wroclaw (Poland)	National University of Life and Environmental Sciences of Ukraine in Kiev (Ukraine)
Category of plant production:	1. Accountancy and audit in farming
1. Rational management of mineral components in farming	2. Statistics
2. Diagnostic of fertilization needs	**3. Biological protection of plants**
3. Diagnostics of plant pests	4. Herbology
4. Diagnosis of crops diseases	5. Crops programming techniques
5. Cultivation and use of energy crops	6. Production of food crops
6. Growing plants in mountainous areas and susceptible to erosion	7. Technical plants
7. Crop rotations in modern agriculture	8. Apiculture
Category of modern technology in agriculture:	9. Agricultural melioration
1. Methods and optimization of microelements fertilizing	10. Agricultural virology
2. Computer consultancy fertilizer	11. Agricultural Zoology
3. Biotechnological methods in plants breeding	12. Gardening in greenhouses
4. In vitro in plant breeding	13. Forest melioration
5. Immune breeding of plants	14. Land registry
6. Soilless plant cultivation	15. Agricultural Microbiology
7. Modern technologies in plant nutrition	
8. Modern technologies in cultivating	

Category of marketing and promotion of agricultural production: 1. Pricing resources in agriculture 2. Banking and securities market securities 3. Information technology in agriculture 4. Use of computer technology in presentation and advertising company 5. Multimedia techniques in the creation of visualization projects 6. Rural cooperatives 7. Organizations of manufacturers groups **8. The economics of plant protection** 9. Agricultural Law 10. Market of agricultural equipment *Category of agriculture impact on environment:* 1. Bioremediation and phytoremediation of soils 2. Plant protection products in ecosystems 3. Waste and unconventional fertilizers 4. The effects of chemicals use in agriculture 5. Rehabilitation of degraded farmland 6. Useful entomofauna agrocenoz 7. Rehabilitation plants 8. Biological aspects of soil fertility 9. Legal and economic instruments in environmental protection	

* Subjects which contain descriptions of the environmental content are in bold

Source: Author's study.

The difference in the list of elective disciplines and their content is quite obvious. Thus, the analysis of the content of educational standards, programs and curricula of training specialists in the key agricultural fields of study at universities in Poland proves that they are straightforwardly focused on formation of environmental knowledge and professional skills of a future specialist, which, in our opinion, promotes the development of ecological agriculture in the country.

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Abstract

The article presents dependence between the development of organic agriculture in the Poland and Ukraine and environmental education of future specialists at the universities of these countries. An important part of the article is devoted to the analysis of the programs of such faculties as Agriculture, Animal Husbandry, Agricultural and Forestry Technology in University of Environmental and Life Sciences of Wroclaw and National University of Life and Environmental Sciences of Ukraine in Kyiv. Great opportunities of selective courses in formation of readiness to develop the organic farming was made. Comparative analysis of the degree of development of organic farming in Poland and Ukraine was also made.

Key words: environmental education, organic agriculture, the content of education, agricultural universities

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Security in Local, European and Global Education

If one does not know to which port one is sailing,
no wind is favourable.
Lucius Annaeus Seneka

The development of science and technology, as well as the changes taking place on the global, regional and local scales make people constantly develop and expand their knowledge, learn new skills and acquire new qualifications. Since life is continually changing, the place of human-beings is set by their intelligence and their ability to adapt to the changes through the appropriate education and the improvement of their skills. "In recent years in Poland the significant changes have been taking place in all areas of social life, which continues the image of the Polish society. The political, economical and social changes have left their mark on the widely understood education for security" (Kurzynowski 1999).

'Security' in Latin refers to *sine cura* (*securitas*), which can be explained as the state without concerns, worries, anxieties, or changes. The dictionaries define 'security' as "the state of being calm, of confidence and without threats and dangers" (the state of being protected, or safe from harm)[1]. In a general sense, the term 'security' must be understood as "a state of the absence of risks; as opposed to chaos, namely, therefore considering the individual perspective, it means mitigating the existential anxiety as the routine practice to develop activities to support confidence in the society" (Giddens 2007).

A. Giddens uses the category of 'ontological security', which means "the sense of lasting, and the order of events, including the events that go beyond the direct experience of the individual" (Giddens 2007). People are limited in their action trying to sort out the reality and act according to the pre-established plan. When they lack the stability, they begin reacting instinctively because of the feeling of fear.

As stated by B. Russell: 'security' as such is the goal of the negative nature, inspired by fear, in addition, one cannot be satisfied with 'security' itself, or imagine that it would bring the golden age" (Russell 1997). The people can feel that their lives are happy, can feel rewarded when their world is stable – secure. However,

[1] See *Webster's Third New International Dictionary*, Könemann 1993, p. 2053.

when they run out of such factor, they are left with anxiety and fear, and other things that also make them happy, are no longer relevant.

"'Security' has been achieved in the society due to getting out the state of nature and entering the state of the country where the power of the country in the form of the positive law was the indicator of the guaranteed functioning of the social contracts, namely, de facto the state of security" (Hobbes 1954). The willingness of 'security', in this approach, is fundamental to the needs of the individual, and those of the group. Therefore, acknowledging the above mentioned definitions and observations, 'security' can be regarded as the opportunity to meet the needs of an existential character, as well as the abilities to provide the development and continuation of the existence in the surrounding world. It is the state of certainty as well as set and achieved goals.

There are many definitions of the term 'education'.

'Education' is derived from the Latin word '*educare*' indicating primarily the phenomenon of "brining out, leading forth" or "carrying something towards the top".

The modern approach demonstrates 'education' which should be understood as the process of shaping the intellectual sources of the society and the mechanism of the social development.

The meaning of the term 'education' was understood in a different way, i.e. "some people associated it with education [...], others with brining up. Currently, the understanding of the concept is regarded as general educational and up-brining processes, including training and up-brining, as well as widely recognized education" (Okoń 1984). There is no possibility of separating the education and up-brining, since these two concepts are interdependent.

According to Zbigniew Kwieciński, "'education' is the number of general impacts on individuals and the groups of people, to influence their development to the highest degree in order to make them aware and become creative members of the social, cultural and national community, as well as to be able to provide themselves with self-realisation of their own self-identity actively by undertaking over personal tasks. It means leading another person to the higher levels of the development and the personal activity in taking complete and specific opportunities. It also means all activities and processes in favour of the development and the state of their effects, that is, the achieved level of the competences, identity and subjectivity" (Kwieciński, 1991). Zbigniew Kwiecinski draws attention to the idea of the social community related to culture and national identity depending on the education of individuals by other people.

'Education' by Tarzycjusz Buliński means "the collective up-brining, providing the knowledge, which is necessary for functioning of individuals in the society as members of some group, organized temporally and spatially in the repeated manner, which is the part of the everyday life and implemented by people specially appointed to do it" (Buliński 2002). The social group providing their experience and knowledge educates other members of the society.

'Education' by Stephen J. Ball "prepares students not only to subordinate to the authority, but also – at least some of them - stress their subjectivity. [...] providing after the year 1800 the new roles to the intellectuals and experts, laying the foundations for the model of the social organization, requiring the formal acknowledgment of professional qualifications, and being at the same time the basic experience in the field of the social contacts with institutions of almost all young people is essential for the [...] analysis of the modern society" (Ball, Foucault 1994). Education is also important in relation to the society, it helps individuals to find themselves – to find their place in the group, which must function continuously, yet must constantly evolve. The pedagogical dictionaries, provide us with the term 'education', understood as "the conscious, organized human activity, the purpose of which is to call the intended changes in the human personality" or "general processes and interactions that aim at changing people, especially children and the young, according to the ideals and objectives of up-brining that exist in a given society" (Okoń 2001). The human impact tends to be the reason for the changes in the perception of the world, thus, 'education' can be understood as overlapping processes occurring during certain time, up-brining and teaching young people, by which consciousness is shaped and values, attitudes and skills are developed. In the lexicon of Polish publishing called 'PWN', 'education' is defined as "the totality of intergenerational interactions aiming at shaping the overall abilities of human life, that is, physical, cognitive, aesthetic, moral and religious ones that make people the essence of maturity, who consciously realize themselves" (Milerski, Śliwerski 2000). 'Education' – it is the process in which the mind and human nature develop by teaching.

In contrast, R. Scharfenberg indicates the institutions that are responsible for initiating the changes. According to him, 'education' tends to be "the continuous process of providing knowledge, skills, values, social norms, cultural heritage of the society with the participation of specific social institutions, that is, schools, kindergartens and other institutions" (Rajkiewicz et al. 1998). 'Education' can, then, be understood as "the processes and interactions that contribute to the human development (including his/her own efforts), or the effects of such processes, or general institutions and social practices aiming at education, upbringing, adapting or training" (Kwieciński 1990). 'Education' is closely related to teaching and upbringing, because they are the ones that direct the person to next stages of the development.

According to B. Niemierko 'education' includes "general educational activities. It is the greatest activities including up-brining, teaching and schooling, it is often used to emphasize the institutional nature of the activities within the family, school, workplace, under the authority of the Ministry of National Education" (Niemierko 2009). Determining 'education' one cannot stick to only one factor, because it is composed of the activities conducted by the school institutions, training centres, and at home in the family. It should be mentioned that the best results are achieved

when stabilization is present there, namely, 'security' among others, they should be mutual and interact with each other. 'Education' is closely linked to learning. "The contribution of 'education' to the economy is one of the factors that have been most often recognized. Therefore, the attention is drawn to two groups of the educational goals/ objectives (Okoń 1998):

- social objectives – due to education, the society aims at providing its members with the conditions for the optimal development, thus, at shaping young people's attitudes and developing skills enabling our abilities to fulfil social tasks in the future,
- individual goals – education provides people with the good and happiness of individuals."

The society that is educated by schooling contributes to the economic, cultural, and economical developments of the country.

"'Education' both prepares for the profession and inspires the innovators. It allows the intelligent people to control their lives, moreover, entirely enjoy their lives. Furthermore, thanks to it, people not only begin to understand the social tasks, but make others hear about their needs. Therefore, the relationship between education and democracy is exposed"[2]. Educated people should use education as the motivation to act for themselves and others for the purpose of the development of the whole society.

The significance of 'education' for the development of Poland can be described as follows: "Education is becoming one of the most important, if not the most important challenges for the future of the Polish society and the country. It is due to the significance of 'education' for the economic development because according to the theory of *human capital*, the knowledge is the requirement for the establishment and absorption of the growth factors, and moreover, for the human development, because any educated person has more opportunities and chances to develop his/ her talents and to meet his/her aspirations" (Golinowska 2000). 'Education' – it is the subject matter for all citizens. The quality of 'education' is directly related to the level of people's lives, whether they are parents, or employers, or citizens, i.e. "The strong educational system on the high level – it is the foundation of the civil society, which is prosperous and democratic" (Fullan 2006). The centre, which is most strongly associated with education is the 'school'. It is defined as: an educational and upbringing institution dedicated to the education and upbringing of children, adolescents and adults according to the approved, in the certain society, goals, objectives, tasks and the educational and upbringing concept, furthermore, syllabuses, achieving these goals/objectives aiming at properly educating the teaching staff, at the educational supervision, local bases, or at other equipment as well as securing budget from the Treasury, local authorities and other sources" (Okoń 1992).

[2] See: Galbraith 1999, p. 61–65.

"It is necessary to introduce the changes to schools in the view of the existing situation in the educational market, where there is a struggle for the client – student. As mentioned in the introduction, the competitors are, in this case, non-public schools, which were established in Poland after 1991, as well as other public institutions operating at the same level in the educational system. Certain regularities, for example, dealing with the way of financing individual institutions, result from the fact that the schools that are of interest in this book show the characteristics of the public organizations, as well as *non-profit* organizations" (Kantyka et al. 2005).

Institutions such as schools have to fulfil certain obligations (as all other organizations, characterized by the production or sales). Therefore, they require detailed studies to understand how they function. Education at schools, taking into account the social and political values, is treated, among others, as:

- the process of permanent learning throughout life;
- the right and at the same time the civic duty as well as the social imperative;
- the instrument of the authorities to realize specific interests and objectives of groups representing social, party, trade union, national, cultural, etc. units;
- the area of social self-regulation, the main factor in the development of human capital, the quality of life of the society, or civilization;
- the type of the symbolic violence, introducing the culture of the dominant group to the representatives of other social groups" (Żegnałek 2008).

Among the above-mentioned definition of 'education', it can be concluded that it is the 'link' between the certain pedagogical concepts, furthermore, it reflects the interaction between people, as well as functioning of the educational system. 'Pedagogy' is the determination of such interactions, which exist to form the human personality. Its task is also to describe and explain the range of the influence of the media, culture and other people on the individual.

Local education and environment education, according to Wieslaw Theiss is, first of all, "the interdisciplinary orientation in the local environment and its activation in the social sciences" (Theiss 2006), secondly, "educational concept that focuses on organizing local societies to deal with social and educational tasks, and on developing the overall level of the local culture, upbringing, as well as social care and social assistance" (Theiss 2006); 'Environmental animation', as one of the main forms of the realization of environmental education tasks, is understood as "the procedure aiming at revealing, developing and organizing the cooperation of the local social powers associated with the local needs, opportunities, plans, etc. 'Education' and 'environmental animation' coexist with 'environmental work' (*community work*) based on the professional providing individuals, groups and organizations with technical, educational and organizational support; social strengthening (*empowering*), namely, the process of developing knowledge, skills and self-confidence, as well as reaching local resources and capabilities, the environmental performance, (*community action*), that is, the activity of acting voluntarily and mutually people for specific local needs" (Theiss 2006). 'Education' aims at taking

care of the development and promotion of the local cultural properties and values. Such support involves the technical assistance, advising in organizing and acquiring the information from the sources of knowledge. Another, also very important task of 'education' is to encourage local entities to cooperate and use such form of organization in other situations. The main objectives of the regional education according to Thaddeus Alexander is "to allow adults to acquire the knowledge about the past, the present and the future of the region; to shape certain attitudes that could guarantee the intensification of the sense of identity considering the region; to create the state of readiness to work for the region in favour of the protection of the monuments, cultivation of habits and customs, positive attitude towards work and other values recognized in the region" (Aleksander 2006). Due to the actions of the local education the valuable knowledge and information would be passed to next generations, they would be able to use them for their own purposes. Acknowledging the previous culture and history seems to be a valuable clue for the modern society, which entered the new era, and the 'flash of time' tends to stop the possibilities of going back in time – to the past.

The wider range of educational activities is included in 'European education'. Poland is the member state of the European Union, the consequence of which is the introduction into the Polish legal system the legal practices of the associated states, including the reform of the educational system. 'European education' is defined in many different ways, it is relevant since the interpretation of the definition determines the goals/objectives set by the teachers themselves in undertaking the activities. There are some basic ways in which 'European education' is understood in Poland.

Kropiwnicki associates 'European education' with "the general teaching and upbringing processes, which aim at developing the awareness of the common history, cultural heritage, geographical, natural and social conditions of Europe; with teaching about causes and processes of the integration of the countries of the so-called old continent, functioning of various European organizations, with the particular emphasis put on the European Union; with developing basic skills so as to prepare for the active life in the democracy considering all levels of local and national governments, to prepare for living in the market economy while preparing young people for life in uniting Europe due to the development of competences in the field of foreign languages, and the use of information technologies, moreover, to develop the attitude of openness and tolerance towards the diversity of other races, cultures and religions, to develop skills of cooperating and collaborating with others and the sense of the responsibility for themselves and others, all of which constitute the subject of European education (Kropiwnicki 2002).

'European education' appears to be something new, something that has recently started functioning, therefore, it is the inspiration for some and the source of fear for others. Being an 'European citizen', it is natural to learn about the common history and cultural heritage as well as to acquire the knowledge about the political, social

and economic conditions as well as the topography of Europe. It is important to shape appropriate European attitudes, which refer to openness and tolerance in the range of racial, cultural, gender or religious areas.

'European education' in the light of the analyzed information is perceived as the ambiguous concept. Kropiwnicki completes the abovementioned definition with his own observations dealing with the development of the citizenship and attitudes connected with it as well as functioning in the society; it is important "not only to inform and teach about the European Union, but also to make people familiar with the issues related to the public life on the European scale, the international relations, preserving human rights, shaping attitudes in favour of the citizenship and democracy, as well as the issues of our European civilization (the organization of social and culture lives). It should also refer to individual interests and ambitions of the youth associated with their lives, and to make young people aware of the fact that most of us even for some time of our lives could live among people representing other nationalities, even here in Poland, since the phenomenon of migration can be observed, namely, the permanent or temporary migration of foreigners. 'European education' must also prepare young people for the multiplex professional and spatial nobilities of people in the coming decades (Kropiwnicki 2001).

'European education' cannot be defined as one specific subject. The concept of 'European education' should, thus, join the curricula of many different subjects. Considering such concept, 'European education' is based on "teaching about Europe, in Europe and for Europe" (Shennan 1991). As a result, we deal with the so-called "ideological" aspects of 'European education'. "Teaching about Europe" should be understood as: providing the basic knowledge about Europe, including the global and local perspectives. Teaching in Europe is perceived as: developing the basic skills needed by young Europeans, learning from the experience of others. Teaching for Europe, therefore, consists of: preparing young people for living in the uniting Europe, the constant contact and cooperative work with other Europeans (PHARE SIERRA Programme 1997). The implementation of such idea is initiated together with developing the awareness of being both the citizen of the state/country as well as of Europe.

The concept of 'European dimension of education' (*European dimension, dimension européenne)* is related to the concept of 'European education'. The concept was officially used in the documents of the EU, and acknowledged in the resolution approved in 1988 (24 May 1988) by the Council and the Ministers of Education. "The fact of clarifying the subject matter probably took place in 1989 at the conference in Palermo. During the meetings, the issues of 'European dimension of education' in school curricula, teacher training, as well as in school textbooks were discussed"[3]. Conversely, the concept of 'Europeanism' is often interchangeably used. The term appeared for the first time in the background of 'education' in the Resolution of the

[3] *Actes de Palerme sur la prise en compté de la dimension européenne dans l'éducation*, Avril 1989, ATEE-ISAS-HATIER, p. 59.

Council and the Ministers of Education of the EU of 9 February 1976. The promotion of 'Europeanism' at schools took place "as a result of the agreement of the Ministers of Education and the member states (3 June 1985) and after the acceptance by the Heads of States and Governments the report of the Interim Committee on "Citizens of Europe" (29 June 1985) (Rabczuk 1994).

By 'European dimension of education' one must understand: "the need for strengthening the sense of European identity among young people, enabling them to understand the value of the European civilization and the grounds on which the EU citizens intend to base their development, such as: the principles of democracy, respect for human rights, but also tolerance and solidarity, which are the result of a better knowledge about "others"; 'Europeanism' is needed to prepare young people for the participation in social and economic developments and their contribution to the creation of the European Union; making them aware of the benefits offered by the Community, but also the challenges that are the result of the wider opening of economical and social areas; enriching the youth by providing them with the historical, cultural and economic aspects of the Union and its Member States, showing the importance of the cooperation of the member states of the EU with other countries/states in Europe and in the world (PHARE SIERRA Programme, 1997). 'European Education' pays special attention to the aspect of community created by Europeans. The sense of the European identity reflects the perceptions of Europe and Europeans all over the world.

The European Union sets four elements of real practical activities in the field of education. These include the exchange of students and teachers, as well as their educational experiences and shaping the contents and forms of curricula and educational programmes in the EU member states. The last of the elements involves the issue of the mutual recognition of diplomas and qualifications.

Scholars believe that the implementation of programmes, i.e. 'European dimension in education' as well as 'European education' can be realised only after shaping the European cultural identity of teachers. "'Humanism' constitutes the basis of such identity and it is supported by the acceptance of diversity and universalism, which meet the requirements of timelessness in relation to the inalienable human rights." (Kwiatkowska 1997). Implementing the programme assumptions of the system, one must be aware of the so-called "educational chain" ("educational path"), which aims at "the realization of the upbringing process and 'European education' starting already in the kindergarten and ending at the stage of the adult education. In the past few years a new, very interesting phenomenon of 'feedback loop' ('feedback mechanism') has been observed in such process. The phenomenon involving the re-education of adults by children has been observed in the process" (Komisja Wspólnot Europejskich, 2002). It is most important, however, to be aware that 'European education' is not a single programme, which can be considered as completed in a short period of time. It is the never-ending process of making young

people aware of the fact from where and where they are going, and the process of showing that only together we can build the future.

"From the observation of the elements of the Polish educational system the concept of 'European education' was acknowledged by the right of the citizenship in the number of Polish schools and universities. Unfortunately, although the programme is of the ministerial character, there is evidence that it is often carried out casually, and out of necessity, moreover, in some educational institutions it has been already "discovered" (PHARE SIERRA Programme – PEIE, 1997). The opportunities offered by 'European education' are enormous, but the process of discovering its benefits is slow due to the insufficient training, or the lack of training of educators.

The field of 'education', which can be defined as 'educational response' to the globalization processes in the global community seems to refer to 'global education', which functions to strengthen the sense of responsibility for the interdependence at the global scale.

'Global education' is the concept of the internationalization of 'education', the purpose of which is to "equip" the young generation with the 'global consciousness'. It promotes the pluralism, tolerance and intercultural dialogue; recognizes the common good of the humanity; reflects the universalist tendencies in the contemporary pedagogy" (Nowa Encyklopedia Powszechna, 2004). All people inhabit one planet, the people are different in their appearance, culture, religion, tradition, etc., nevertheless, it is important to know how to find the agreement and to develop the so-called 'global awareness'.

"'Global education' opens people's eyes and minds to the realities observed in the world and meets the requirements of taking action in the field of providing greater justice, equality and Human Rights for all. 'Global education' tends to be the global dimension of Education for Citizenship and includes Development Education, Human Rights Education, Education for Sustainable Development, Education for Peace and Conflict Prevention and Intercultural Education"[4]. 'Global education' goes beyond facts and information. It includes skills, attitudes and values that are thematically linked, as well as integrated and multidisciplinary curricula. It also includes active learning and the use of modern teaching methods, together with multimedia solutions.

'Global education' embraces teaching about the problems and issues that are not found just within the specific national borders, but are of the international character as well as interconnected cultural, ecological, economic, political and technological systems. 'Global education' also includes the knowledge that allows for understanding and respecting our neighbours, the knowledge that comes from other cultures, perceives the world through the eyes and minds of others and that

[4] *Deklaracja Edukacji Globalnej z Maastricht (The Maastricht Global Education Declaration),* Europejski Kongres Edukacji Globalnej, Maastricht 2002, p. 45.

makes people aware that other people in the world need and want the same things[5]. 'Global Education' involves such areas of the programme that refer to Environment Education, Intercultural Education, Education for Peace and Conflict Prevention, Development Education, Human Rights Education and Education for Democracy. However, it is more than just the sum of these areas, since it includes the reflection on their interdependence and on the fact how they cross national borders.

'Education' is widely understood because of its numerous functions and how many types of it there are. Due to the diversity of such objectives, which are aimed at by the various types of education, one must also acknowledge that there are a lot of dangers and they are also varied. To provide 'security' in 'education', the willingness to cooperate in various fields tends to be the essential factor. Such cooperation should take place among students and teachers, as well as at the higher level, involving education and the local community, not to mention the European one. The tasks of every human being at the time of their existence refer to 'global education', dealing with problems not only of the humanity as the society, but also with the environmental problems of the planet. It is also important to cooperate within the education and its reformation so as to consider the state/country policy, and in particular the agreement dealing with the economical and economic arena.

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Security in Local, European and Global Education

Abstract

People are limited in their action trying to sort out the reality and act according to the pre-established plan. When they lack the stability, they begin reacting instinctively because of the feeling the fear. The development of science and technology, as well as the changes taking place on a global, regional and local scales make people constantly develop and expand their knowledge, learn new skills and get new qualifications. Since life is continually changing, the place of human-beings is set by their intelligence and their ability to adapt to the changes through the appropriate education and the improvement of their skills. 'Education' – it is the process, in which the mind and human nature develop by teaching. 'Education' is closely

related to teaching and upbringing, because they are the ones that direct the person to the next stages of development. The field of 'education', which can be defined as 'educational response' to the globalization processes in the global community seems to refer to 'global education', which functions to strengthen the sense of responsibility for the interdependence at the global scale. 'Education' is widely understood because of its numerous functions and how many types of it there are. Due to the diversity of such objectives, which are aimed at by the various types of education, one must also acknowledge that there are a lot of dangers and they are also varied. To provide 'security' in 'education', the willingness to cooperate in various fields tends to be the essential factor. Such cooperation should take place among students and teachers, as well as at the higher level involving education and the local community, not to mention the European one.

Key words: safety, responsibility, local education, European education, global education, students, teachers, the community.

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Sustainable Development in the Consciousness of Students

The development of the civilization and consumerism found in the lifestyles of the society do not always take into account the behaviours which manifest the visualization of the population of the existence in accordance with the rights and respect for the nature. The reasons for such situation can result from the variety of the educational neglect as well as the created by the media materialistic lifestyles. However, the level of the awareness can be significantly improved by the competent preparation of future teachers so as to implement environmental issues and the concept of 'sustainable development' in the educational process. To find out about the level of the respondents' knowledge and to get the comprehensive information dealing with such issues, the research studies involving 568 students of Biology, Geography, Chemistry, Physics and Mathematics were carried out.

Sustainable development – terminological establishments

The problems of the environment protection tend to be the response to the growth of the industry, technology development and lifestyle changes in the society, which are not always in accordance with the laws of nature. Every problem allows for the creation of the strategy of actions that aim at stopping the degradation and at the prevention of the negative effects. Such issues are involved in the sustainable development programme.

Quoting the statements from the Earth Summit conference:

> The idea of sustainable development was created in opposition to the traditional development, i.e. programme-based economic growth. The critique of the existing model of the human development, overexploitation of natural resources, environmental degradation, as well as the discussion related to the problem of the growing gap between the rich and the poor (Pawłowski 2005).

Poland as the participant of the Earth Summit Conference in Johannesburg in 2002 implements the principle of 'sustainable development' and introduces it to

the internal politics of the country. It is confirmed by the regulations found in the Constitution of the Republic of Poland, namely:

Article 5: The Republic of Poland shall safeguard the independence and integrity of its territory and ensure the freedoms and rights of persons and citizens, the security of the citizens, safeguard the national heritage and ensure the protection of the natural environment pursuant to the principles of sustainable development[1].

Article 74: 1. Public authorities shall pursue policies ensuring the ecological security of current and future generations[2].

The realization of the concept of 'sustainable development' is not possible by the use of the legal, or economic mechanisms as well as other business – organizational undertakings if they are not accompanied by the understanding and support of the whole society. The most important are primarily the changes in the awareness and attitudes towards the natural and social environments (Sarzała 2005).

Coming back to the very beginning, we come across the report dealing with the issues of 'sustainable development'.

In 1987 the report of the UN World Commission on Environment and Development under the chairmanship of Gro Harlem Brundtland was released. The report was called "Our Common Future" and it defined the quoted earlier, i.e. at the beginning of report, the concept of 'sustainable development' (*le développement durable*). It was emphasized that the creation of the fully sustainable way of life required various actions in different regions of the world. First of all, it was necessary to integrate the activities in three key areas:

1. the economic growth and even distribution of benefits;
2. the protection of natural resources and the environment;
3. the social development[3].
4. Searching for the meaning of the term/concept of 'sustainable development', the following interpretations were found:

> 'Sustainable development' means that the economic growth leads to the increased social cohesion (including the reduction of the social stratification, equalling opportunities, preventing from marginalization and discrimination) and improving the quality of the environment by, inter alia, reducing the harmful effects of the production and consumption on the environment, the protection of natural resources[4].

The civilization and the environment should not compete with each other, however, there is a question of if it is not possible in today's world:

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[1] *RP Constitution of 2 April 1997*, J.L. No. 78, item 483, p. 3.

[2] Ibidem, p. 7.

[3] http://www.ekoedu.uw.edu.pl [Access: 21.11.2007].

[4] http://www.ekoedu.uw.edu.pl [Access: 21.11.2007].

> [...] at the current level of the civilization, 'sustainable development' is possible, that means such development that meets the needs of the present without compromising the ability of the future generations to meet their own needs[5].

The concept is defined in different ways, however, we can find in each and every of the definitions, the significant sentence, i.e., the essence of the concern for the natural resources that are around us:

> 'Sustainable development' of Earth is the development that meets the basic needs of all human beings and which conserve, protect and restore the health and integrity of the Earth's ecosystem, without compromising the ability of future generations to meet their own needs and without going over the limits of long term capacity of the Earth`s ecosystem[6].

Can the attitude of the society towards the goods of the nature become the determinant of the everyday existence of the society? Lubomir Domka considered such issues:

> At the dawn of the new millennium, the world had to face the need for the global challenges of our civilization degrading nature. Many symptoms indicate that the destruction of natural ecological systems tends to be the greatest danger to the future of the human species and the future of the planet. It can be observed that the anthropopressure with regards to the environment has become the modern indicator of the system of social values that requires the radical questioning and the rejection. It is necessary to quickly and firmly give up many extravagant aspirations and the ignorance towards the nature, its overuse, absolutizing the power of technology and material well-being [...] (Domka 1998).

What is the wealth of wildlife with regards to the chase of today's everyday life? Or can the wealth of wildlife, according to the laws of nature, be identified with the material one?

> Wealth [...] – it is the management of some excess over what is needed only for the maintenance of life [...]. The real wealth is in fact the management of the excess – the net product. The one and only nature or the ground can be such source, because only in the production of the ground the forces of nature are revealed [...] (Bartkowski 1979).

The need to protect the natural wealth was already commented in distant times by one of the members of the Club of Rome, whose interpretation of the words is dealt with by Z. Gazdowicz:

> Aurelio Peccei, the earlier president of the Club of Rome also wrote about the necessity of the revolutionary change in thinking about the world and the human nature. He emphasized that the great successes of the industrial era led to the degeneration of the developmental processes [...]. Such development, according to this precursor of the global thinking, refers to and takes into account only the question of the quantity

[5] http://www.ine-isd.org.pl [Access: 6.01.2008].

[6] http://pl.wikipedia.org/wiki/Zrównoważony_rozwój [Access: 17.01.2008].

> and materiality, neglecting the quality, and at the same time overexploits raw material resources and destroys the natural environment, which must be considered as the so-called 'blind' development, leading to the inevitable collapse of the civilization (Gazdowicz 1995).

Everyone has the perspective of the future, therefore it is worth identifying it with the issues of the protection of the environment.

For the future it is essential to build a new intellectual and moral formation of the society, which is responsible for the fate of their own and other generations, non-human beings, recognizing the affirmation of life, the integrity of forms of nature (Domka 1998).

The concept of 'sustainable development' has grown on the basis of the considerations related to the wildly understood ecology. There has been a lot of confusion considering the ideas of sustainable development and sustainability. The most common mistake to be acknowledged is the incorrect identification of the so-called sustainable development and eco-development. The latter term/ concept refers only to the environmental dimension included in the programme of 'sustainable development' and sustainable development values and objectives (Warych 2005).

The concept can be referred to the social dimension and to make an attempt to interpret it from a different perspective than the existing ones.

Sustainable development means that the economic growth leads to the increased social cohesion (including the reduction of the social stratification, equal opportunities, preventing from marginalization and discrimination) and to the improvement of the environment quality by, among others, the reduction of the harmful impact of the production and the consumption on the environment, the protection of natural resources (Kozłowski 2000).

Discussing the issues referring to the key concern discussed in the chapter of the monograph, the words of Danuta Cichy should be quoted:

> Sustainable development – it is the concept expressing a new philosophy of the world order. It sets the new order of activities developed by the countries at the end of the last century, the ideal vision, the image of the world which we should lead consistently and severally (Cich 2005).

The awareness considering the value of environmental goods existed already in the primitive civilizations, although it was not suggested by individual programmes.

The process of the aspiration for sustainable development began at the early stage of the civilization development of human-beings who lived and worked in accordance with the rhythm of nature, without burdening the natural environment by their activity. The total number of the local threats was so small that nature could deal with them itself successfully (Tuszyńska, Łyczkowski 2005).

Currently, such aspects and action programmes are looked for so as to develop the awareness of the nation, together with the initiation of the theoretical aspects of everyday life.

Therefore, sustainable development does not refer to the environmental protection in the traditional sense, known as the so-called type of 'the end of the pipe' (even though many still understand it in this way). It is definitely and in particular the 'development', but conditioned by the ecological space, and by the assumed synergies of the economic, environmental and social, aspects, moreover, it is safe and beneficial for human-beings, the environment and the economy. Therefore, it is not considered to be the 'brake' which stops the progress, but it is its 'stimulus'. It is also a way of life and a form of the ethics, giving the opportunity to select the forms of the consumption and the production. It is also the 'fashion', since the consumers associate the organic product with something safe and healthy, as well as with something that is up to date[7].

The legal record demonstrates the concept in the following way:

> Whenever the Act refers to [...] sustainable development – it is understood as the socio and economic development, in which the process of integrating political, economic and social actions takes place, with maintaining the balance of nature and the stability of the basic natural processes, in order to guarantee the ability to meet the basic needs of the communities or citizens of the present generation and future generations[8].

Interpreting the subject principle, the strategy of actions in order to achieve the decent life can be learned. Sustainable development also known as eco-development:

> [...] it is found in the place where people assume to face the limitations associated with the finiteness of the planet and independent from the human rhythm of nature [...]. It is the strategy of getting the decent life in the range of what is physically and biologically possible. It guarantees the basic needs of present and future generations maintaining at the same time the sustainability of functioning of the natural environment as well as the natural diversity of both species and ecosystems[9].

Can the manifestation of the concern for the wealth of nature at present save the consumption potential for the new generations? We can answer this question by reading the following definition: "Sustainable development connects economic progress with respect for nature and the social development, creating better prospects for the future generations"[10].

The following terms should be also paid attention to.

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[7] http://www.mos.gov.pl [Access: 6.01.2008].

[8] Art. 3 item 50 of the Act of 27 April 2001 on the Environment Protection, J.L. 2001 No. 62, item 627.

[9] http://www.ine-isd.org.pl [Access: 8.01.2008].

[10] http://www.wwf.pl [Access: 8.01.2008].

Sustainable development is:

- the development that does not endanger the natural environment, allowing the future generations to use the Earth's resources as much as we use them successfully today,
- the principle of "don't do unto others what you don't want others to do unto you" (or, also known as "what goes around, comes around") the term 'the others', then, refers to our descendants,
- providing the next generations with the sufficient amount of supplies – sufficient resources (including the capital ones) necessary to maintain the consumption per capita at the highest possible level (economy version of the biblical principles)[11].

'Sustainable development' can be also defined considering the economical point of view, guided by using and linking the distant currents:

Sustainable development – it is the philosophy of the socio-economic development harmonized with respect to the environment. It enables for the re-conciliation of the efforts of the satisfactory economic result and the deep concern about the social and natural environments.

The pillars of Sustainable Development:

• economic efficiency – the profit for the community taking into account the social and environmental costs,

• concern for the environment – the protection of the natural non-renewable resources, minimizing the negative impact on the environment,

• social sustainability – creating new jobs and working actively to improve the quality of life[12].

Among 27 principles of the Rio Declaration on Environment and Development, the special attention should be paid to the following aspects:

Principle 1: Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature.

Principle 21: The creativity, ideals and courage of the youth of the world should be mobilized to forge a global partnership in order to achieve sustainable development and ensure a better future for all**.**

Principle 25: Peace, development and environmental protection are interdependent and indivisible[13].

Current threats to the environment are caused by the common way of the existence, and at the same time the improvements and enhancements associated with it. Such way of life can appear as the challenging exam, which nature cannot pass. The awareness of this problem was discussed by me and Barbara Parka:

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[11] http://www.energia.eco.pl [Access: 8.01.2008].

[12] http://www.kogeneracja.com.pl [Access:: 8.01.2008].

[13] Rio Declaration http://www.ko.poznan.pl/pub/ftp/Edukacja_zrownowa-zonego_rozwoju/DEKLARACJA_Z_RIO_1992.pdf [Access: 8.01.2008].

> We live in the era, in which the rapid development of sciences and technology in various fields of life has been taking place. This rapid development, often uncontrolled, and in many cases being subject to the laws of the ruthless exploitation and consumption, has become, undoubtedly, the force that threatens the existence of the mankind. The important problem thought will be the subordination of social needs and aspirations to the environmental possibilities (Parka, Żeber-Dzikowska 2005).

Searching for the causes of the environmental degradation by human-beings, the contents that are considered to be a form of the justification for such actions can be found in the foreign literature.

> In many regions the poor population with the high biodiversity – mainly agricultural one – [...] often has no other choice but to exploit the surrounding environment to meet the needs of the human existence. Under such conditions, the rapid population growth can lead to the collision of traditional customs, which were ecologically bearable [...], but they are becoming increasingly difficult to bear for species and ecosystems, i.e. when there are more and more residents and they are also consuming more and more[14].

Analyzing these words, one can consider the amount of entities, apart from the human activities, which are the cause of the deteriorating state of the environment:

> The arguments of environmentalists against the excessive consumption indicating the increase in the population and growing level of the private consumption, the use of disposable materials led to the total depletion and degradation of ecosystems [...]. However, the religions extend the argumentation [...] that simple lifestyle saves the good [...], which allows human-beings to cultivate the relations with the world[15].

To preserve the wealth of nature and to cease the unconscious destruction, the knowledge of the factors and the creation of security systems that would allow to control the negative changes are needed. This is also expressed by E. Fleszar:

> One of the factors that most seriously threatens the biodiversity is the destruction and the pollution of the natural environment. In order to prevent nature from it, the policy of the sustainable eco-development is realised This strategy involves the prevention from the pollution and contamination at the source (Fleszar 2005).

Methodology of the personal research

Preceding the analysis of the research results, the main problem was formulated, furthermore, the specific problems were formulated and the main hypothesis together with the specific hypotheses were created.

Main Problem: Whether and to what extent are the students of Natural Sciences prepared to implement the issues of sustainable development? In order

[14] http://www.hewdream.org, translation [Access: 23.04.2008].

[15] http://www.hewdream.org, translation [Access: 25.04.2008].

to interpret the above mentioned problem more precisely the following specific problems were created:

1. From what sources do the students get the information dealing with the concept of 'sustainable development'?
2. What impact have various forms and time taken to acquire information on the level of gained knowledge in the field of 'sustainable development'?
3. Are the students of Natural Sciences able to interpret the definition of 'sustainable development' correctly?
4. Do the students know the assumptions of 'sustainable development' and take actions in favour of the local community?

Main Hypothesis: The students of Natural Sciences are well prepared to implement the issues of 'sustainable development'.

Specific Hypotheses:

1. The information dealing with 'sustainable development' is acquired by the students from many sources and at different stages of education.
2. The acquired knowledge at the specific stage of education and its forms differentiate the level of the students' knowledge in the field of 'sustainable development'.
3. The students of Natural Sciences can interpret the definition of 'sustainable development'.
4. The students are familiar with the assumptions of 'sustainable development' and requirements relevant to the implementation of the activities for the local community.

To assess the level of the knowledge of the specific topics by the students studying different fields of Natural Sciences, the diagnostic survey method was employed. In the present studies the survey was considered to be the research technique, and the questionnaire consisting of 20 questions was found to be the research instrument. The respondents were informed about the purpose of the research. The questions were of the open and closed types, with the diverse contents allowing for reliable and varied responses. Not all questionnaires were, however, comprehensively and conscientiously filled in, since mainly open-ended questions were skipped by the respondents, most likely due to the lack of knowledge dealing with the topic. Although they did it willingly, it was nevertheless not done well enough, which can cause some objections.

Tab. 1. Quantitative analysis of the respondents according to their sexes

Differentiation according to sex	Fields of studies									
	Biology		Geography		Chemistry		Maths		Physics	
	N	%	N	%	N	%	N	%	N	%
Women	144	66.4	57	49.1	54	47.4	32	33.0	8	33.3
Men	73	33.6	59	50.9	60	52.6	65	67.0	16	66.7

The research studies ware carried out in the time period of 2007–2010. They were conducted among 568 students of Natural Sciences. The studies involved 217 students of Biology, 116 of Geography, 114 of Chemistry, 97 of Mathematics (Maths), and 24 of Physics. The table below shows the quantitative statement.

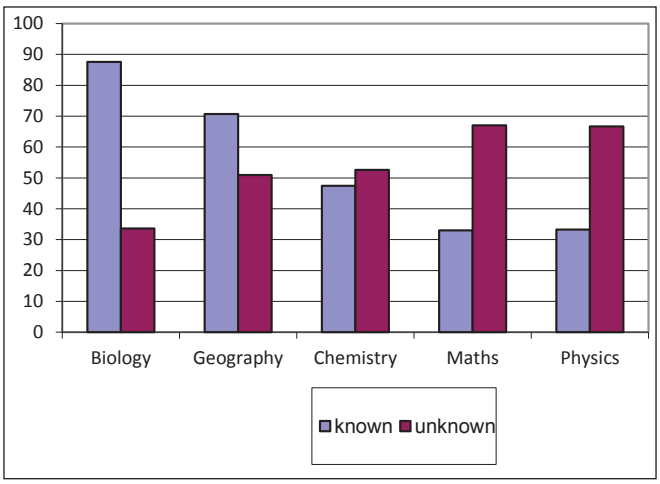
Analysis of the results of the empirical research

In order to determine the resources of information and the level of the students' preparation to implement the issues of 'sustainable development' and to obtain reliable information, all of the respondents were asked to complete the questionnaire consisting of 20 questions.

The first question required the recognition of the knowledge of the term/ concept of 'sustainable development'.

Tab. 2. The knowledge of the term/concept of "sustainable development''

The knowledge of the concept of 'sustainable development'	Fields of studies									
	Biology		Geography		Chemistry		Maths		Physics	
	N	%	N	%	N	%	N	%	N	%
known	190	87.6	82	70.7	54	47.4	32	33.0	8	33.3
unknown	27	12.4	34	29.3	60	52.6	65	67.0	16	66.7



Graph 1. The knowledge of the term/concept of "sustainable development''

The first question concerned the knowledge of the concept of 'sustainable development'. Although the research studies were conducted among the students of different fields of Natural Sciences, not all of them confirmed the knowledge of the above concept. Based on the analysis of the obtained results it can be concluded that not all of the students from the five selected fields of Natural Sciences were familiar with the term/concept of 'sustainable development'. The Biology students (190

students – 87.6%) and the Geography students (82 students – 70.7%) demonstrated the greatest knowledge. Much more insignificant knowledge of this term/concept can be seen among future chemists (54 students – 47.4%), not to mention the least positive responses ticked by the students of Physics (8 students – 33.3%) and Mathematics (32 students – 33%).

The second question required to demonstrate their own interpretation of the term/concept of 'sustainable development', and among 568 of the respondents only 114 responded to it, representing 20.1% of the total number.

In the next question, the respondents were asked to show the circumstances in which they learned about the term/concept of 'sustainable development' for the first time.

Tab. 3. Educational stages, during which the respondents heard the term/concept of 'sustainable development' for the first time

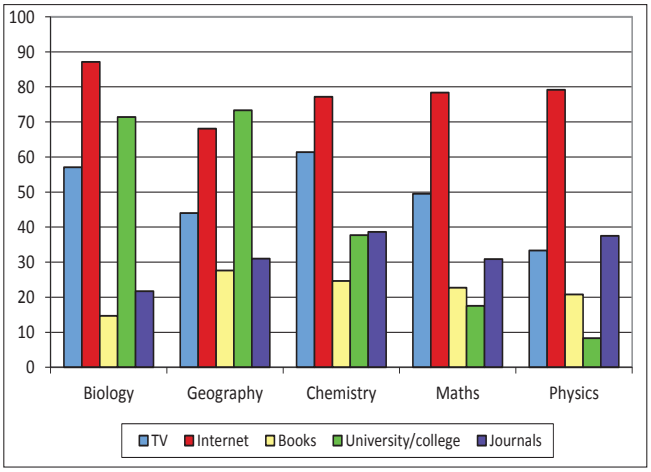
Educational stages	Fields of studies									
	Biology		Geography		Chemistry		Maths		Physics	
	N	%	N	%	N	%	N	%	N	%
Primary school	16	8.4	13	15.9	10	18.5	6	18.8	2	25.0
Secondary school	45	23.7	29	35.4	13	24.1	13	40.6	4	50.0
University/college	87	45.8	32	39.0	15	27.8	8	25.0	2	25.0

The knowledge about 'sustainable development' can be gained at different stages of the education. The presented data seem to show that the knowledge in this area was acquired at universities/colleges, and it was indicated by most people. Such answer was marked by 144 people, representing 39.3% of the students familiar with the term/concept. A large group (104 people – 28.4%) answered that the concept was discussed in secondary school. Primary schools as the source of information was acknowledged by 47 people – 12.8%. Definitely the smallest number of Biology students – only 8% – learned about the concept in primary schools, and the greatest number at universities/collages – 45%.

Tab. 4. Sources of information associated with the environment protection

Information sources	Fields of studies									
	Biology		Geography		Chemistry		Maths		Physics	
	N	%	N	%	N	%	N	%	N	%
TV	124	57.1	51	44.0	70	61.4	48	49.5	8	33.3
Internet	189	87.1	79	68.1	88	77.2	76	78.4	19	79.2
Books	32	14.7	32	27.6	28	24.6	22	22.7	5	20.8
University/ college	155	71.4	85	73.3	43	37.7	17	17.5	2	8.3
Journals	47	21.7	36	31.0	44	38.6	30	30.9	9	37.5

In the next question, the respondents were asked to indicate the sources of information dealing with the environment protection.



* Percentages do not create total –100%, since we deal with multiple choice questions

Graph 2. Sources of information associated with the environment protection

The idea of 'sustainable development' is inextricably linked with the rules and environmental projects associated with nature protection. It is impossible to acquire the knowledge of nature without the knowledge and interest in the field of the laws of nature. The surveyed students indicated the answers from the following options, such as: literature, the Internet, universities/colleges, books, TV, journals, so as to show the ones that they mainly benefit from. The respondents gained the knowledge, first of all, from the Internet. It was indicated by 465 people (44.8% of the total responses). The Internet was the most popular with those studying Biology – 189 people (87.1% of the surveyed students). Also the university/college appeared to be the significant source of knowledge for the students, specified by 155 people (71.4%). Analyzing the respondents studying Biology and their other choices, TV was marked by 124 people, which constituted 57.1%. The fewest students of Biology used the literature. Among the geographers, 85 people (49.7%) as the source of information indicated university/college, 52 (30.4%) of the respondents acquired the knowledge from the Internet, while only 32 people (18.7%) looked for information in books.

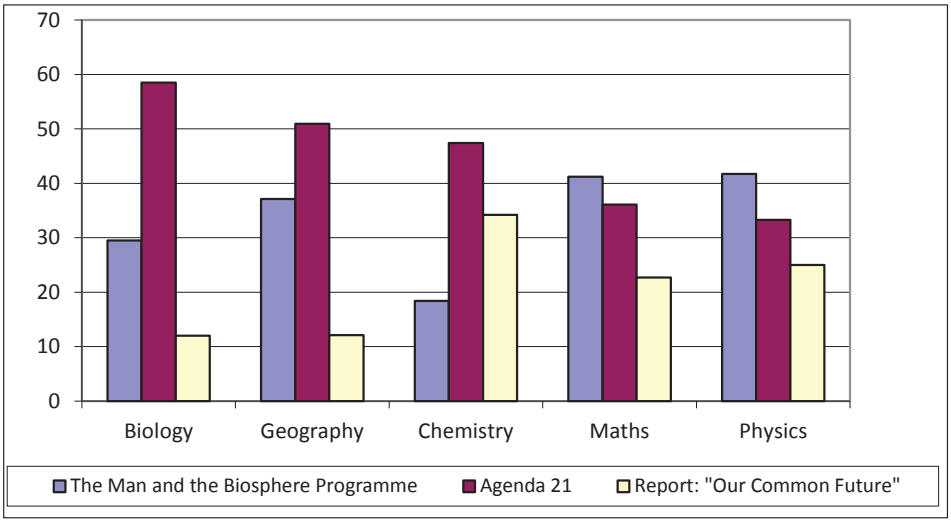
The Internet proved to be the most important source of information among all Natural Sciences apart from Geography. The students of Geography believed that the university/college appeared to be the greatest sources of knowledge. It is disturbing, however that all of the students referred to books as the source of information really rarely, i.e. 21% of all the responses; the Biology students ticked such answer even less frequently, that is 14.7% of them. On the basis of the results it can be concluded that the students of Natural Sciences gained their knowledge from similar sources.

'Sustainable development' - it is the concept dating back to the 1970s. During the survey the students of Natural Sciences were asked about the place and the year of the implementation of the existing assumptions of the discussed programme. Among four answers, only one was correct. The collected data showed that many people marked the answer accidentally. The correct answer, i.e. the conference in Stockholm in 1972 was marked by 187 people – 33%.

In 1992 at the UN conference in Rio de Janeiro known as the Earth Summit, the document Agenda 21 was acknowledged. The questionnaire involved the requirement of stating the correct name of the document.

Tab. 5. The knowledge of basic documents established during the Earth Summit

Names of documents	Fields of studies									
	Biology		Geography		Chemistry		Maths		Physics	
	N	%	N	%	N	%	N	%	N	%
The Man and the Biosphere Programme	64	29.5	43	37.1	21	18.4	40	41.2	10	41.7
Agenda 21	127	58.5	59	50.9	54	47.4	35	36.1	8	33.3
The Report "Our common future"	26	12.0	14	12.0	39	34.2	22	22.7	6	25.0



Graph 3. The knowledge of basic documents established during the Earth Summit

The students surveyed indicated one of the possible answers: the "The Man and the Biosphere" programme, Agenda 21, the report "Our Common Future". The correct answer was provided by 283 people, which comprises 49.8%. Agenda 21 was marked correctly by 127 students of Biology (58.5%). Among 116 interviewed students of Geography, 59 of them (50.9%) made the correct choice. The correct

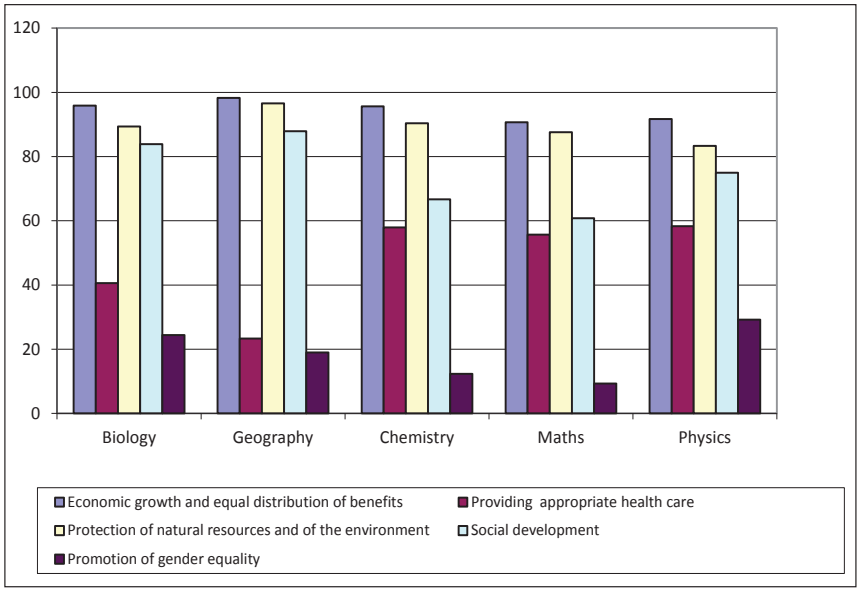
answer was indicated by 47.4% of the Chemistry students, while only 36% of the students of Mathematics and 33.3%. of Physics.

'Sustainable development' is in the field of interest of many organizations. Therefore, the students were asked to indicate such organizations known by them. The insignificant number of responses was gathered, since considering 568 of the interviewed only 62 people (10.9%) provided the name of the organization. Unfortunately, the data indicated that students had not had any information about the subject.

Tab. 6. Assumptions of sustainable development for the benefits of the society

Possible answers	Fields of studies									
	Biology		Geography		Chemistry		Maths		Physics	
	N	%	N	%	N	%	N	%	N	%
Economic growth and equal distribution of benefits	208	95.9	114	98.3	109	95.6	88	90.7	22	91.7
Providing appropriate health care	88	40.6	27	23.3	66	57.9	54	55.7	14	58.3
Protection of natural resources and of the environment	194	89.4	112	96.6	103	90.4	85	87.6	20	83.3
Social development	182	83.9	102	87.9	76	66.7	59	60.8	18	75.0
Promotion of gender equality	53	24.4	22	19.0	14	12.3	9	9.3	7	29.2

* Percentages do not create total -100%, since we deal with multiple choice questions

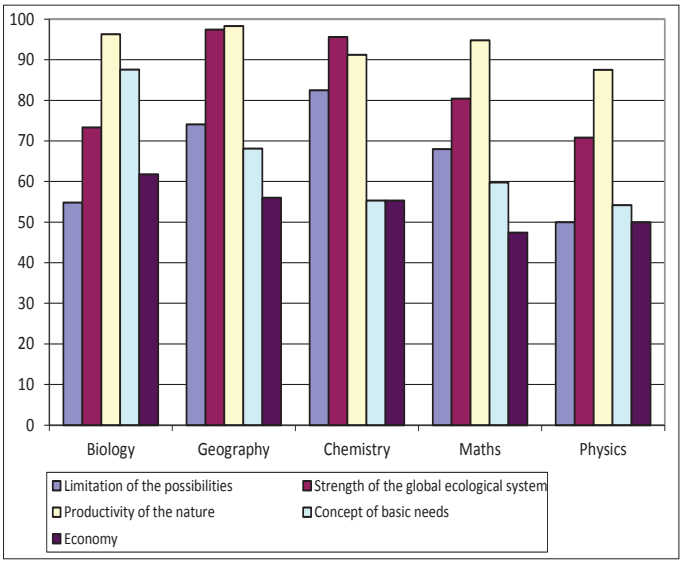


Graph 4. Assumptions of "sustainable development" for the benefits of the society

To achieve the fully sustainable model of social life, one should be aware of and willing to implement rules imposed by sustainable development in their daily lives. It is due to certain actions in some areas of life. The students selected the three assumptions most important to them from the given ones. The analysis of the results showed that the economic growth and equal distribution of benefits were the most common answers (95.9% of the respondents studying Biology, 98.3% – Geography, 95.6% – Chemistry, 90.7% – Maths, 91.7% – Physics), The answers were followed by the protection of natural resources and of the environment (89.4% of the respondents studying Biology, 96.6% – Geography, 90.4% – Chemistry, 87.6%, – Maths, and 83.3% –Physics). Then, the respondents indicated the social development (83.9% – Biology, 87.9% – Geography, 66.7% – Chemistry, 60.8% – Maths, 75% – Physics). The data indicated that the selected answers were very accurate and they were in accordance with the main objectives of the report "Our Common Future".

Tab. 7. Basic assumptions of 'sustainable development'

Possible answers	Fields of studies									
	Biology		Geography		Chemistry		Maths		Physics	
	N	%	N	%	N	%	N	%	N	%
Limitation of the possibilities	119	54.8	86	74.1	94	82.5	66	68.0	12	50.0
Strength of the global ecological system	159	73.3	113	97.4	109	95.6	78	80.4	17	70.8
Productivity of the nature	209	96.3	114	98.3	104	91.2	92	94.8	21	87.5
Concept of basic needs	190	87.6	79	68.1	63	55.3	58	59.8	13	54.2
Economy	134	61.8	65	56.0	63	55.3	46	47.4	12	50.0



* Percentages do not create a total of 100%, since we deal with multiple choice questions

Graph 5. Basic assumptions of "sustainable development"

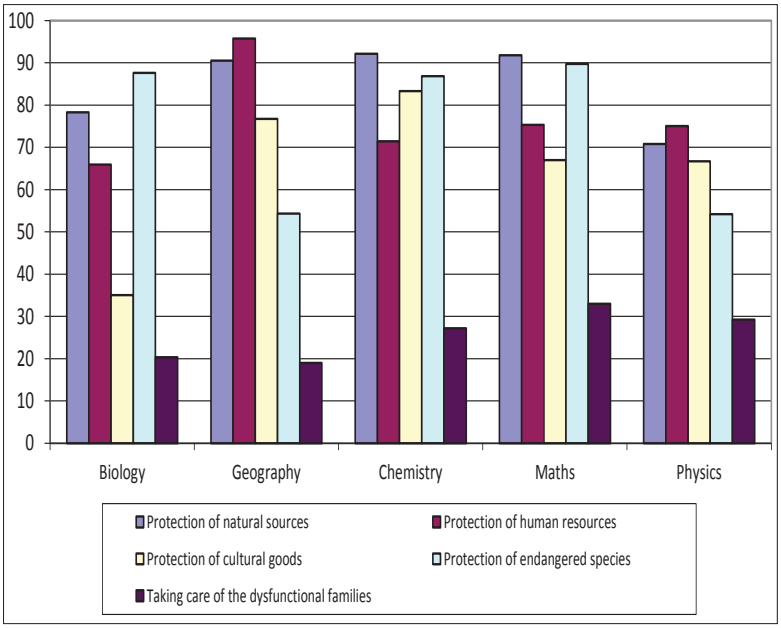
The next question required students to identify the main three principles of 'sustainable development'. They selected them from the five possibilities listed in Table 7. Among biologists the most popular responses were the following: the productivity of nature (96.3%), the concept of basic needs (87.6%), the strength of the global ecological system (73.3%). The students of Geography most often chose the productivity of nature (98.3%), the strength of the global ecological system (97.4%), the limitation of possibilities (74.1%). The students of Chemistry indicated, respectively, the strength of the global ecological system (95.6%), the productivity of nature (91.2%), the limitation of possibilities (82.5%). For the students of Mathematics the most important issue selected by them in the field of 'sustainable development' was the productivity of nature (94.8%), followed by the strength of the global ecological system (80.4%) and limitation of possibilities (68%). The respondents studying Physics marked successively the productivity of nature (87.5%), the strength of the global ecological system (70.8%) and the concepts of basic needs (54.2%).

Tab. 8. Social activity in the realisation of 'sustainable development'

Kinds of activities	Fields of studies									
	Biology		Geography		Chemistry		Maths		Physics	
	N	%	N	%	N	%	N	%	N	%
protection of natural sources	170	78.3	105	90.5	105	92.1	89	91.8	17	70.8
protection of human resource	143	65.9	96	82.8	82	71.9	73	75.3	18	75.0
protection of cultural goods	76	35.0	89	76.7	95	83.3	65	67.0	16	66.7
protection of endangered animal species	137	63.1	63	54.3	99	86.8	87	89.7	13	54.2
taking care of the dysfunctional families	44	20.3	22	19.0	31	27.2	32	33.0	7	29.2

In the next question the students were asked to list the major areas of social activities, connected with the programme of 'sustainable development'. Their task was to identify the three right answers out of the five possible ones. The results were the following: the students of Biology selected most frequently the protection of natural resources (78.3%), the protection of human resources (65.9%), the protection of endangered species (63.1%). Among studying Geography, the preferred responses included the protection of natural resources (90.5%), the protection of human resources (82.8%), the protection of cultural goods (76.7%). Analysing the questionnaires filled in by future chemists, it could be found that they mainly marked the following responses: the protection of natural resources (92.1%), the protection of endangered species (86.8%), the protection of cultural goods (83.3%). The students of Maths indicated successively: the protection of natural resources (91.8%), the protection of endangered species (89.7%) and the protection of cultural goods (89.7%). For the respondents from the institute of Physics the most important elements of the activities connected with the idea of 'sustainable development' were proven to be: the protection of human resources

(75%), followed by the protection of natural resources (70.8%), and the protection of cultural goods (66.7%).



* Percentages do not create total -100%, since we deal with multiple choice questions

Graph 6. Social activity in the realisation of 'sustainable development'

It must be acknowledged that the answers are comparable. It also applied to the sub-point, which was the least frequently pointed out in the various groups of the respondents, namely taking care of the dysfunctional families. Among the Biology students it was ticked by 20.3%, in case of Geography students by 19%, Chemistry students by 27.2%, Maths students by 33%, and Physics students by 29.2%.

In 1992, the Convention was accepted in Rio de Janeiro. It required the countries to develop the national strategies, plans, programmes of the environmental protection and sustainable development. Among the three possibilities presented in the investigation only one was correct, i.e., the Convention on Biological Diversity. Among 568 people interviewed, it was selected by 195 (34.3%) of the respondents. It was different according to different fields of studies, namely, 86 Biology student indicated it (39.6%) while just 41 of the students of Geography (36%), 36 (31%) of Chemistry, 7 (29.2%) respondents studying Physics and 25 (25.8%) respondents from the institute of Mathematics.

To have the effects of the particular project and to have it noticeable, the appropriate range of activities must be distributed so that every unit could have the opportunity to implement certain principles in their lives. It also applies to the issue of 'sustainable development'. The respondents were asked about the range of activities, which should take place in the programme for the main topic of the

work. The answer was simple, since it was supposed to involve the scale of impacts that was as great as possible, and even the smallest administrative units should be involved in the project. Among the four answers the respondents had to choose the correct one. It meant that they should tick the response providing the following information, namely, 'sustainable development' programme activities should take place on the global, national, regional and local scales. Such response was marked by 429 (75.5%) students: 190 (87.6%) student of Biology, 89 (78.1%) of Geography, 77 (66.4%) of Chemistry, 15 (62.5%) of Physics, and 57 (58.8%) of Mathematics. The remaining respondents chose the incorrect answer or skipped the question.

The last question examined the knowledge whether the students selected for the research were able to choose the correct term/concept of 'sustainable development' included in one sentence. It appeared that among 568 interviewed, 495 (87.1%) chose the correct definition, which considered that 'sustainable development' was the process of satisfying the humans' needs having in mind the environment protection. The students of Biology, that is 198 of them (91.2%) provided the correct answers, whereas in the remaining fields the situation was as follows: 98 of Geography, (86%), 97 of Chemistry (83.6%), 77 of Mathematics (79.4%), and 19 of Physics (79.2%). There were also 46 (8.1%) incorrect indications, among which there was the most common interpretation of the problem, i.e. "economical and economic development" as well as "emotional state, in which every child can be". None of the interviewed indicated the response "scientific field", whereas 33 (5.8%) of the respondents did not respond to the question at all.

Discussing the outcomes

After conducting the extensive research dealing with the level of the preparation of students of Natural Sciences to implement the issues of 'sustainable development', it appeared that the hypotheses were not consistent with the reality. Analyzing the studies, differentiated results were obtained. It applied to the information contained in the responses to the individual questions. Due to the significant number of the students, their choices were varied. In many cases it could be noted that the term/concept of 'sustainable development' was known, or associated with something, but too superficially to be able to interpret it individually, or go into its details. It could be due to the lack of the commitment to conscientiously fulfil the received questionnaires, or that the students were not adequately prepared to carry out such issues. The studies showed that the sources of information were diverse, but used incorrectly. It can be proved by the incorrect interpretation of the definition of 'sustainable development', as well as the lack of the awareness associated with the dangers connected with the contact with nature and possibilities of prevention.

The knowledge of the term/concept of 'sustainable development' was not satisfactory, because just a little more than half of the respondents (366 people – 64.4%) knew the term/concept – the correct definition, however, it was known only

by a small number of the respondents, i.e., only 127 people, representing 22.4% of all respondents.

The similar studies were conducted in the time period of 1998–1999 at the Department of Biology and Environmental Protection –The Pedagogical University in Kielce (Polish: WSP) while writing Master's theses. The results are provided by Danuta Cichy:

> Only one third of the students wrote the correct definition. [...] 10.7% of the respondents reported the correct characteristics, but incomplete one. 20% of the students answered incorrectly, and 46% did not answer this question at all" (Cichy 2000).

The research carried out at the department also provided the information obtained about the quantity and quality of the acquired knowledge at various stages of education.

> [...] The young people were asked whether, in their opinion, the knowledge gained at school in the field of ecology and environmental protection was adequate, or if it needed to be developed and supplemented. 67.3% of the young people believed that the information gained on this subject at school needed to be supplemented (Cichy 2000).

The data can be applied to the results obtained from the analysis of the survey based on the questions relating to gathering information about 'sustainable development' for the first time. Students indicated that the amount of demonstrated knowledge was minimal, since only 8.4% of Biology students who knew the term/concept of sustainable development heard about it at primary schools, they gained most of the information at colleges/universities, as reported by 45.8% of the respondents. The results indicated the insufficient interest in the provided contents of ecology and low development of interests at the early stages of education. It could cause lesser sensitivity to these problems in the future.

The level of knowledge about the environment protection and sustainable development, which is inextricably associated with it, is not at the sufficient level. The similar research results are discussed by A.M. Wójcik:

> [...] the results supported the idea that there is little preparation of young people to take action to protect the environment. The level of knowledge in this field does not allow active and fully conscious participation in the implementation of sustainable development, especially due to the fact that young people do not understand this concept [...]. It is necessary, though, to improve the already existing forms of education and to search for the new ones (Wójcik 2002).

By analyzing the data from the conducted survey it can be concluded that despite many potential sources of information and their usage, most of the students indicated the Internet – 79.4% – as the main source of information for the respondents. Only the Geography students indicated university/college (73.3%) as the primary source of information. It is interesting, however, that university/college was generally treated by the respondents as the source of information in the second place (53.2%), and then they referred to television (53%).

Such results are basically confirmed by the conclusions of the research that I conducted with Lesława Nowak. We claimed that:

> The non-formal environmental education is the important part of educating and environmental upbringing. The popularization of the knowledge dealing with the natural processes and their impact on the lives of the societies, not to mention the knowledge of the environment, takes place by providing people with different sources of pro-environmental information [...]. The widest range of influence referred to mass media, such as: television, radio and newspapers [...] (Nowak, Żeber-Dzikowska 1998).

Many people and experts in the field of such issues are aware of the fact, however, that it is the school that educates – brings up and focuses on the appropriate intercourse with the surrounding world. These types of institutions are able to provide the richest resources of knowledge. Conversely, it cannot be always recognized. It is confirmed by the results of the survey, since among those studying Biology only 16% acknowledged the concept of sustainable development at primary schools. The consequences of such situation are discussed by me earlier: "The young people have the insignificant knowledge about the rules of functioning in national parks (60.75%) and in other forms of nature protection areas" (Żeber 2002). The awareness of such issues and the possibilities of being in the opposition to them are argued by Elżbieta Buchcic:

> In the era of implementing the new reform, such contents should be included in the syllabuses, textbooks, and their implementation must include all stages of education, but not only through the formal education. A great role here is played by the informal education addressed to the whole of society (Buchcic 2005).

It is important in the implementation of sustainable development issues to acquire the knowledge of the document called Agenda 21, which is also shown in the consideration of E. Fleszar:

> The assumptions of Agenda 21 should be implemented in practice. The transition from the theory to practical actions should be the aim of all, namely, teachers, pupils, students, as well as parents and children (Fleszar 1998).

The results showed that students had the inadequate awareness of the possibilities of implementing the principles of Agenda 21, proved by the lack of information about the document - only 49.8% of students indicated it correctly, and only 33.3% of the respondents seemed to be able to name its assumptions correctly. Such results cannot calm fears about the state of nature, it can be done, however, by the responses of students from Szczecin (from the teaching workshop), which were mentioned by E. Fleszar. The issues were related to the objectives of environmental education, to acquiring and developing the sensitivity associated with it: "[...] the students had confirmed that they knew the assumptions of the environmental education (98.5%), supporting the development of the ecological awareness as the need for time – 100%" (Fleszar 1998). The obtained data showed

that despite little knowledge of the details dealing with the ecological projects, the students were aware of the implementation of the rules, which allowed for avoiding the destruction of nature.

The absence of some information in the potential of the knowledge of the society as well as the respondents results from the unfulfilled requirements in the range of acquiring the ecological knowledge are the result of the formal education at different stages of education. It may be the consequence of the lack of the teachers' preparation for such types of actions. We can read about the conducted research on such topic among teachers in the article by dr. E. Buchcic:

> [...] It is shown that only 38% of teachers claimed to obtain the content-related and methodological preparation to implement the sustainable development issues at the university/college, moreover, 43% were in favour of the fact, but they did not receive such knowledge [...] (Buchcic 2005).

It can be concluded that, in certain matters, students and teachers, pupils and the public can adequately use the gained knowledge potential. It can also be seen in the aforementioned article by Barbara Parks and Ilona Dzikowska Żeber that:

> [...] in the area of Education for Sustainable Development, it can be stated that the methods and forms of work enable students to acquire the appropriate level of knowledge. The learned skills and shaped attitudes are reflected in the existing actions for the environment (Parka, Żeber-Dzikowska 2005).

It is justified to continue the research further among students of the humanities and pedagogical studies as well as to analyze the future results. On such basis, it can be decided to what extent it is desirable to develop the knowledge, i.e. the knowledge and skills in the range of the current understanding of sustainable development.

Conclusions

The studies aimed at finding the answers to the research question, i.e. if and to what extent the students of Natural Sciences are prepared to realize the issues of sustainable development.

The results of the research studies showed that the preparation of students to realize the issues of sustainable development was not appropriate. The analysis of the results did not confirm the main hypothesis and specific hypotheses.

1. More than half of the students tended to be familiar with the term 'sustainable development', however, only one fifth of the respondents seemed to be able to give their own definition and to interpret the concept correctly.

2. The students gathered the information on sustainable development during the educational activities at all stages of education, however, the greatest amount of knowledge was gained during the university/college lectures and activities.

3. The vast majority of the respondents indicated the Internet as a source of gaining information, far fewer people mentioned other mass media, even rarer than the mass media they indicated the literature.

4. The sources as well as the time of gathering of the information differentiated the amount of the acquired knowledge on 'sustainable development'.

5. The surveyed people were not able to justify the assumptions of the programme scientifically, however, they were intuitively aware of the actions that needed to be taken and practiced thanks to the appropriate lifestyles for the sake of the environment.

6. The majority of the respondents did not know the initial activities that had created the basis for the construction of the idea of 'sustainable development'.

7. The surveyed people were aware of the necessity for an intervention by the public action against the environmental, social, economic threats.

The results of the studies based on the following questionnaire were discussed in the publication "Dydaktyczne tropy zrównoważonego rozwoju w edukacji" (English: "Didactic tropes of sustainable development in education") edited by Ewa Szadzińska in the chapter written by Ilona Żeber-Dzikowskiej, namely, "Wiedza studentów o zrównoważonym rozwoju" (English: "The knowledge of students on sustainable development"). Published by Impuls Publishing House, Cracow 2013, pp. 59–80.

"Questionnaire for students of Natural Sciences"

I kindly ask you to fill in this questionnaire. The questionnaire is completely anonymous and your answers will not be used for any other purpose than to demonstrate the analysis of the results for the scientific research.

Please, fill in the questionnaire in a legible and reliable way.

Prof. dr hab. Ilona Żeber-Dzikowska

Sex:

□ woman

□ man

Field of studies:

……

……

Year of studies :

……

……

1. Do you know the term/concept of 'sustainable development'?

□ yes

□ no

2. Please, define, using your own words, what the concept of 'sustainable development' meas……

……

……

3. Where did you hear about the concept of 'sustainable development' for the first time
- □ primary school
- □ secondary school
- □ university/college
- □ at home
- □ personal sources of information associated with personal interests

4. The information about the concept of 'sustainable development' you get from:
- □ literature
- □ Internet
- □ university/college

5. What sources of information do you use to get the knowledge about the environment protection?
- □ TV
- □ Internet
- □ books
- □ journals

6. Official assumptions about the concept of 'sustainable development' were introduced during the conference in:
- □ Stockholm in 1972
- □ Bern in 1978
- □ Yalta in 1945
- □ Washington in 2003

7. Were the concepts of 'sustainable development' introduced during the educational activities/classes?
- □ yes
- □ no

If yes, where?
- □ primary school
- □ high school
- □ university/college

8. Please estimate your knowledge about the concept of 'sustainable development' using the scale from 1 to 5:

1	2	3	4	5

9. Do you agree with the statement that 'sustainable development' is the development, in which the exploitation of the raw materials and the technical development are kept in harmony so as to maintain the possibility of satisfying humans' needs and aspirations now and in the future?
- □ yes
- □ no

Justify your opinion

……

……

10. In 1992 in Rio de Janeiro during the United Nations Conference on Environment and Development, also known as the Earth Summit, the important document was initiated.

Please mark the correct answer using X

□ The Man and the Biosphere Programme

□ Agenda 21

□ the report "Our common future"

11. Agenda 21 is:

□ International Action Programme – the perspective of the 21st century

□ Act of Environment Protection

□ Economy and Development Programme of the United Nations

12. The legal record of the activity of our country in terms of 'sustainable deve-lopment' can be found in:

□ Regulations of the Minister of Agriculture

□ Environmental Education Act

□ Polish Constitution of 1997

13. 'Sustainable development' is the concept that is of interest of many organizations, i.e. the United Nations Programme for the Environment Protection, the European Commission. Please, provide us with organizations that also deal with this programme:

……

……

14. For the first time, the concepts of 'sustainable development' appeared in:

□ Ecological Student Associations at universities/ colleges

□ environmental institutions

□ German Higher Education Institutions for Forest Rangers

15. The creation of the completely sustainable way of life requires different actions in certain areas. Please tick the most important:

□ the economic growth and equal distribution of benefits

□ providing appropriate health care

□ the protection of natural resources and of the environment

□ the social development

□ the promotion of gender equality

16. 'Sustainable development' is based on three main assumptions. Please tick them:

□ the limitation of the possibilities

□ the strength of the global ecological system

□ the productivity of the nature

□ the concept of basic needs

17. 'Sustainable development' brings together three areas of the social activity among the people. Please select them from the following ones:
- □ the protection of natural resources
- □ the protection of human resource
- □ the protection of cultural goods
- □ the protection of endangered animal species
- □ taking care of the dysfunctional families

18. In 1992 in Rio de Janeiro the convention of making the countries create national strategies, plans and programmes of the environment protection as well as the concepts of 'sustainable development' was established. Please tick the appropriate convention:
- □ ecological
- □ on biodiversity
- □ on environment protection

19. The actions in favour of 'sustainable development' should take place
- □ on the global and national scales
- □ on the local scale
- □ on the regional scale
- □ on the global, national, local, regional scales

20. 'Sustainable development' is understood as:
- □ emotional state in which every child can be
- □ economical and economic development
- □ scientific field
- □ process of satisfying the humans' needs, having in mind the environment protection.

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Sustainable Development in the Consciousness of Students

Abstract

Sustainable development – it is the philosophy of the socio-economic development harmonized with respect for the environment. It enables to re-conciliate the efforts of the satisfactory economic result and the deep concern about the social and natural environments. The development of the civilization and the consumerism found in the lifestyles of the society do not always take into account the behaviours which manifest the visualization of the population of the existence in accordance with the rights and respect for nature. The reasons for such situation can result from the variety of the educational neglect as well as the created by the media materialistic lifestyles. However, the awareness level can be significantly improved by the competent preparation of future teachers so as to implement environmental issues and the concept of 'sustainable development' in the educational process. To find out about the level of the respondents' knowledge and to get the comprehensive information dealing with such issues, the research studies involving 568 students of Biology, Geography, Chemistry, Physics and Mathematics were carried out. The studies were aimed at finding the answers to the research question, i.e. if and to what extent the students of Natural Sciences are prepared to realize the issues of sustainable development. The realization of the concept of 'sustainable development' is not possible using legal or economic mechanisms as well as other business – organizational undertakings – if they are not accompanied by the understanding and support of the whole society. The most important changes are primarily the changes in the awareness and attitudes towards the natural and social environments. We live in the era, in which the rapid development of sciences and technology in various fields of life has been taking place. This rapid development, often uncontrolled and in many cases subject to the laws of the ruthless exploitation and consumption, has become, undoubtedly, the force that threatens the existence of mankind. The important problem, then, will be the subordination of social needs and aspirations to the environmental possibilities.

Key words: sustainable development, awareness, knowledge, students, education.

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The Idea of Sustainable Development in the Area of Environmental Protection at the Lower and High School Level

Introduction

Human aspirations to achieve high economic growth cause over-exploitation of natural resources. The rapid and dynamic development of civilization generates rapid economic growth and maximization of consumption at the expense of environmental degradation (Kozlowski 2005).

The United Nations Conference in Rio de Janeiro in 1992 resulted in the adoption of the concept of sustainable human development towards improving quality of life in every aspect of maintaining a healthy environment for future generations. As a condition for the proper implementation of the objectives of sustainable development (SD), educational activities in this field were considered. The next summit of the UN in Johannesburg ended with the announcement of the Decade of Education for Sustainable Development (DEZR) 2005–2014 and the implementation of the 2005 Strategy for Education for Sustainable Development (ESD). The need to spread the idea of SD is included in the section of Article 5 of the Constitution: *"The Republic of Poland [...] ensures the protection of the environment, guided by the principle of sustainable development".*

Education in the field of environmental protection is now important in the face of the challenges posed by the development of civilization, and in the context of the search for appropriate solutions to facilitate the adaptation of the members of the society to function in intensely changing circumstances. Contemporary educational tasks are dependent on the general trends in the perception of human responsibility for the environment, according to the meaning found in nature and the need to preserve biodiversity. Developing students' competences in the field of biological interest and taking actions to protect nature is dependent on the preparation of teachers in this area and their responsibility in the education of youth (Potyrała 2010). ESD status in Poland, unfortunately, is not satisfactory due to the fact that quite a large number of teachers is not familiar with or is unable to explain the concept of sustainable development (Tuszyńska 2010). At the same time an

increasing number of teachers begin to see the need to move the subject of the SD and are increasingly willing to take part in training sessions and workshops on this topic.

The objective of international cooperation for solving contemporary problems is education which, is an effective means to implement the idea of SD. The Agenda 21 (Ch. 36 Section 36.5 b) clearly specifies that governments should develop measures to integrate environmental issues and include them in the curriculum in all subjects at all levels of education (Panasiewicz 2010). The objective of the strategy for education for sustainable development is to develop an incarnation of the principles of ESD for not only formal education, but also non-formal learning, in order to equip people with the knowledge and skills by raising their competence in the field of living in harmony with nature and actions to solve environmental problems caused by excessive exploitation of natural resources, urbanization, industrialization, and automotive. An important aspect of this is also educating teachers on sustainable development and ensuring public access to educational materials on SD. The implementation of subjects of SD into school curricula at all levels of education should be based on the actions taken by teachers and students in the search for solutions to current environmental problems (ESD Strategy).

A competent teacher is a pillar of the objectives of ESD at school. Attitudes and skills that will help them live in the community require the teacher to deepen their knowledge in the field of SD (Samonek-Miciuk, Pedryc-Crow, 2010). In pursuing the subject of SD, a teacher should use problem activating teaching methods such as discussion, simulation, modelling, games method, laboratory method, as well as philosophical analysis, fieldwork information technology, communication and mediation.

The strategy of ESD stresses that a significant impact on the education of both children and adults is non-formal education. Training in this area should address the various professional groups, particularly teachers transferring students the examples of good practices of SD. All these activities should be supported by governments to promote conscious consumption among its citizens and the media to disseminate reliable information on the SD.

The substantive scope and methodical implementation of Sustainable Develop-ment in the area of environmental protection resulting from the requirements of the core curriculum of general education.

The ESD strategy is reflected in the records of the core curriculum of general education of 23 December 2008 in the form of inventory needed to meet the issues and shape by the level of education students' competences. At the same time, the way of formulating the general and specific requirements influences the choice of the teacher's teaching methods and techniques.

During the execution of the biology subject in high school, the student should present the causes and analyze the effects of global warming. Students should justify the need to segregate waste in the household and the need for special handling of

waste batteries, fluorescent tubes, overdue medicaments, propose means to reduce the consumption of water and electricity and the production of wastes in households.

At the high school level, in the field of basic biology section, teaching biodiversity and its threats are provided in the course of this chapter. The student should, among other things: describe biodiversity at various levels, depict themes of nature, present the impact of modern agriculture on biodiversity, provide examples of species that have become extinct, endangered species, outline the differences between active and passive protection, represent legal forms of nature protection in Poland and give examples of plants and animals which are protected species. Moreover, they should justify the need for international cooperation to prevent threats to nature and give examples of such cooperation (e.g. CITES, "Natura 2000", Agenda 21).

The authors of the core curriculum put even more demands before a student studying biology as an extended subject. Among the general requirements, conservation and the environment are as important as knowledge and understanding of the principles of sustainable development. The presentation of an attitude of respect towards each other and all living beings, the environment describes attitudes and behaviours of a responsible person who benefits from nature and the environment, has knowledge of animal rights and an can analyse their relationship to living organisms and the environment. What should be emphasized, among the specific requirements, is the presentation of human impact on biodiversity, knowing the examples of this impact (risk to native species, introduction of alien species), justification of the need to preserve old varieties of crops and breeds of farm animals as part of biodiversity, justification of active protection for the preservation of selected species and ecosystems.

Education for sustainable development takes place not only during biology classes, but also in the daily functioning of the students in the school environment by representing the appropriate behaviour and participation in school activities that promote the idea of sustainable development.

Methodology and organization of research

In order to diagnose the degree of realization of the idea of sustainable development the research was conducted in 2014 in schools where methods were used to observe and analyze documents. The observation was conducted by students of the Pedagogical University in Krakow who had teaching practice in schools. The observations were carried out in 105 schools in Krakow and smaller towns of Małopolska and Podkarpackie regions – in 75 junior high schools and 35 high schools. The observers prior to the start of the research have been adequately trained and provided with instructions and observation sheet, prepared on the basis of the literature (Angrosino 2010). Observation sheet was divided into 6 areas: hygiene and health of members of the local community, nutrition, physical activity, relationships between members of the school community, school management and organization of the school, the local environment. It was found that observers in each school have

made a compact record of events observed in each area for 5 days during the so-called long break and for 20 minutes after lessons. Some of the information necessary to complete the worksheet was obtained by the observers during discussions with members of the school community. Each observation sheet had the surname and name of the observer. The comparative analysis was made within the areas of observation between various types of schools. Separate analyses have been carried out for junior high schools and for secondary schools. In addition, apart from the observations, there was also an analysis of curricula and education implemented in the surveyed schools carried out. In total, 10 programs were analyzed - 6 programs for junior high and 4 to high school. The study was carried out in accordance with a unified guide program analysis. There was searching for keywords like: ecological and health-related topics, human rights, combating inequality in various spheres of life. On the basis of programs supplemented for each school, the frequency of the appearance of the general and specific terms was counted.

For the purposes of this study, only those aspects of sustainable development were selected, from all areas of observation and analyzed curricula, that are associated with environmental protection.

Test results

Results of the analysis of curriculum conducted in surveyed schools.

The general keywords most often occurring in the biology curriculum implemented at the junior high school were: "Ecology" (carried out by 20 schools), "Man and the Environment" (11 schools). In contrast, the least (only 1 time) appearing keywords are: "Pollution and protection of the atmosphere", "Matter and energy in the ecosystem".

Among the detailed keywords "Biodiversity" has appeared 14 times (most of all), followed by: "The impact of interspecies" (12 times) and "Global Warming" (11 times). In the curriculum there are also keywords related to the economy and human activities: "Ways of saving water and electricity" (9 times), "The human impact on the purity of water" (5 times), "Energy management" (3 times), "Waste separation in the household" (2 times), "Renewable energy sources" (1 time), "Generation of waste in households" (1 time).

At the high school level the most frequently appearing general keywords are: "Threats to biodiversity" (11 times), "Protecting the environment" (7 times) and "Protection of nature in Poland" (6 times). The keywords only appearing once are: "Protection of species of living organisms" and "Interspecies dependence."

In comparison to junior high schools, in high schools there are new keywords such as "International forms of nature" (4 times) and "Biotechnology in Environmental Protection" (3 times).

Among the detailed keywords the ones that appear most frequently are: "Human impact on biodiversity" (9 times) and "Biodiversity of the Earth" (5 times). Whereas detailed keywords, including issues related to human activity, which

appeared in the study, are: "The advisability of preserving old varieties of crops and breeds of farm animals as part of the conservation of biological diversity" (3 times), "Economic and social aspects of the relationship between man and his activities and environments" (2 times), "The modern system of the world economy and its effect on the degradation of environmental resources" (2 times) and "The effect of modern agriculture on biodiversity" (1 time).

The keywords "International initiatives in the field of environmental protection" and "The idea of sustainable development" appear in all three curricula.

In the educational programs for both junior high and high schools, the most attention is being paid to building respect for nature and carrying out such actions, as "Clean Up the World" and ecological knowledge quizzes.

Results of observations – Education for sustainable development in the field of environmental protection – junior high school.

Actions taken by the junior high schools in environmental issues are shown in Table 1.

Tab. 1. Activities in junior high schools in environmental issues

Activities	
Waste segregation	In the 98% of schools there are bins for waste segregation, which students and staff willingly use.
	Segregated garbage: paper, plastic, glass, aluminium, batteries.
	Only one school did not segregate waste.
Light saving	All schools promote saving light by establishing energy-efficient light bulbs, turning off the lights when it is bright enough or when there is no one on the corridors.
Water saving	Only 20% of schools emphasize saving water – these are rare cases.
Paper saving	In 90% of schools teachers print double-sided and reduce the font size of text; the same test is used in several classes.
Promoting public transport and bicycles	In 20% of schools, such a solution is used in order to reduce pollution and traffic jams.
	In the one of the schools in Krakow, to propagate actions like that, the district community put forward the motion to the city authorities to use free transport within the old city.
Using renewable sources of energy	There are solar panels installed.
Caring about order and repairing the equipment	All schools rarely buy new electronic devices if there is a chance for repair.
	All schools emphasize the general order and taking care of the property for both school and students.
Disposal and recycling	Campaigns such as collecting waste, large size materials, CDs refer to 80% of schools.
Campaigns / projects for environmental actions	A campaign such as "Pure Lesser Poland".
	A campaign such as "Clean Up the World" appears in all schools.
	Planting trees refers to 20% of schools.
	School competitions, festivals promoting environmental protection take place in 85% of schools.

Eco products	Shops stocked with fresh, healthy products to protect the health and promote the belief that organic products are good occur in 30% of schools.
	Using eco-bags is promoted in 40% of schools.

Results of observations – Education for sustainable development in the field of environmental protection – high school.

Activities taken by high schools in the field of environmental protection are presented in Table 2.

Tab. 2. Activities taken by high schools for environmental protection

Activities	
Waste segregation	In 98% of schools there are coloured waste bins and boxes properly marked for used batteries.
	The organization of the campaign for collecting caps for charity on almost 90% of schools.
	In a few schools, there are no segregation waste bins, but the conducted interview implies that students segregate waste at home.
Light saving	All schools do not use the lights in sunny days.
	The rooms are well lit, and when using the lamps students switch them off during the breaks.
	Only in a few schools the lights are switched on all the time, and computers and projectors are turned on during breaks.
Water saving	Only half of the schools take actions to save water.
Paper saving	Teachers can save paper by printing tasks for several students on a single sheet and using them in several classes.
	In a few schools, paper consumption is very high – teachers print materials for students in large numbers.
Promoting public transport and bicycles	80% of students arrive to school on foot or using public transport.
	An increasing number of them are travelling to school by car.
Using renewable sources of energy	Only 6 out of 35 schools benefit from such solutions.
	95% of the students are familiar with alternative energy sources but do not use them.
Caring about order	Few students smoke cigarettes, and throw cigarette butts on the lawn.
Campaigns / projects for environmental actions	"Clean Up the World" campaign takes place in all schools.
	In 85% of schools, students organize and share eco-themed contests.
	In a small number of schools (10%) there is the ecological club.
	In a few schools (10%) there are lessons that promote ecological behaviour.
Citizens' budget and the local environment	Actions funded from the citizens' budget are not widely promoted at the beginning, so the students are not involved in them.

The activities of schools in terms of achieving the objectives of sustainable development in the field of environmental protection are becoming more apparent. More and more often we hear about the behaviour designed to lead to taking actions

to nature. Teachers and local authorities insist on the development in this field. In most schools the most developed aspect is the one concerning protection of the environment and the promotion of waste segregation, saving energy and paper, as well as taking care of order and property.

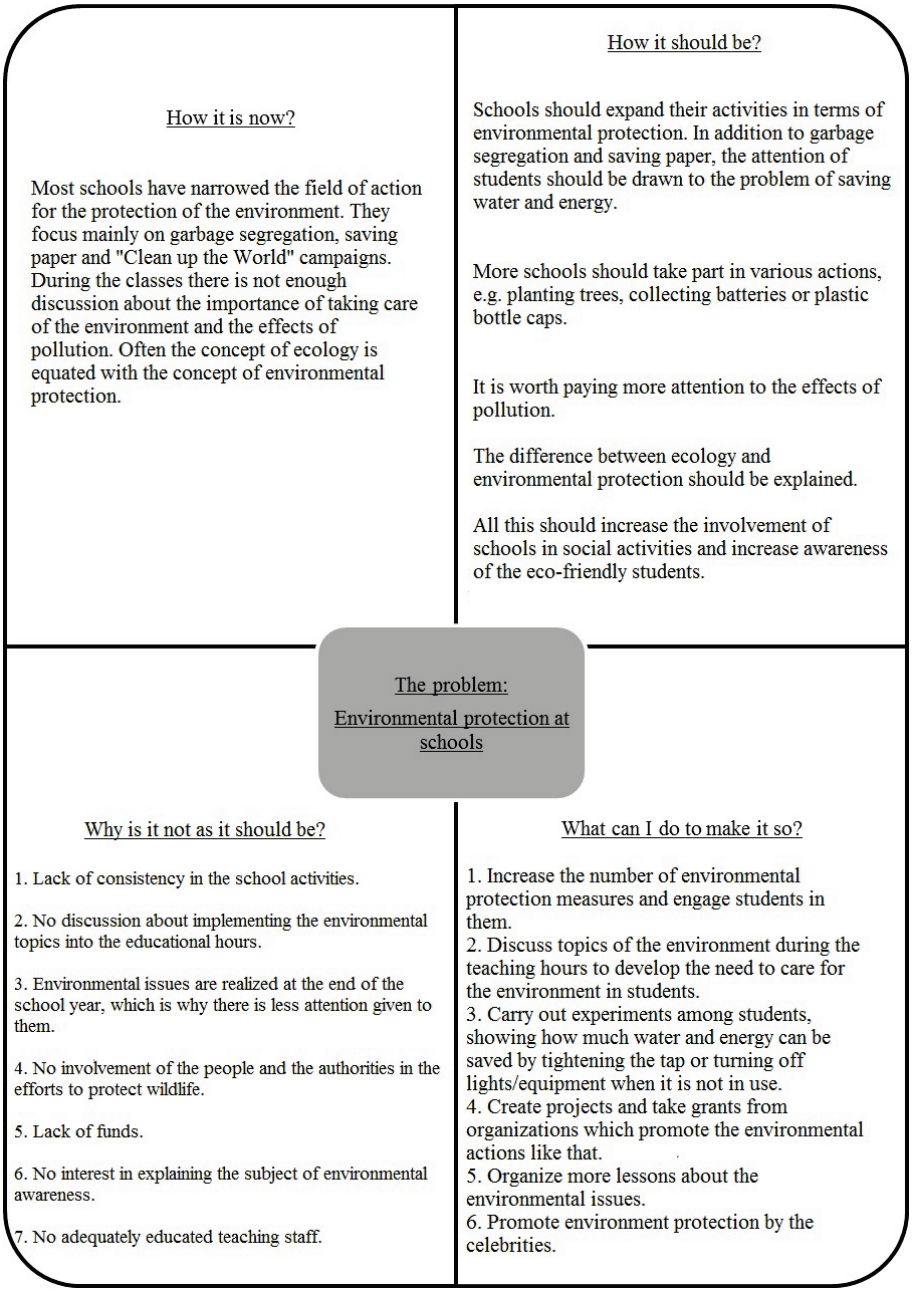
In larger cities (e.g. Krakow) a common way to implement the concept of SD in environmental protection was to promote public transport instead of commuting to school by car. Teachers willingly complied with this rule by using buses, trams, and even walking on foot. Unfortunately, the problem is to promote activities in terms of rational water management and use of renewable energy sources (e.g. the use of solar collectors). Also, the actions involving the planting of trees or the promotion of sustainable consumption are taken rarely.

Summary

The acquisition of habits with conscious attaining sustainable development is related to the educational activities of a school, the local community, and a variety of non-formal education institutions. Their scope of activity includes the development of students' beliefs that the functioning of the natural environment depends on the actions taken by the man to influence the improvement of the functioning of the nearest surroundings. Observations of nature, environmental actions, and rational intervention in the environment at the place of residence are translated into the environment and maintaining biodiversity at a global scale.

The observation and analysis of the curriculum were supplemented with a discussion with the students of second year of biology Master's students with a teaching specialty participated in the study as observers. On this basis, a diagnosis of the current situation and proposals for action to increase pupils' awareness of sustainable development outlined in Scheme 1 were established.

The ESD is a kind of permanent education, which should be started at the lowest level of education and take place through both formal and informal education. Certainly it is the school (due to the range of influence) that is the main area of the ESD implementation by developing awareness and competence. The students should be drawn the problem of taking pro-environmental actions at the local, national and global level.



Scheme 1. Proposals for raising the pupils' awareness of sustainable development in the field of environmental protection

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The Idea of Sustainable Development in the Area of Environmental Protection at the Lower and High School Level

Abstract

Sustainable development of society largely depends on the implementation of the concept of education towards respect and protection of the natural environment. The keyword 'think globally – act locally' is increasingly reflected in educational activities and educational schools that through the implementation of sustainable development, spread students' knowledge about nature conservation among students.

The analysis of the data relating to the implementation of sustainable development in the area of environmental protection in the junior high school and high schools has submitted the information that increases pro-environment awareness in Polish schools, and the involvement of teachers and students in activities for the benefit of nature are becoming larger and more diverse.

Key words: sustainable development, education for sustainable development, environmental protection, junior high school, high school

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The Role of Associations of Municipalities in Non-formal Education

Introduction

The provisions of access to natural resources are implemented by a number of entities at all administrative levels, from the legislative and executive powers by the minister of the environment and consultative institutions and the ones advisory to the government (Kobielska 2003). Proper management of the natural environment and local activities, although implemented on a small scale, improves the state of the local environment. Municipalities play a key role in the socio-economic development of local communities seeking to act in accordance with sustainable development (Tuziak 2008).

Sustainable development is a fundamental objective of the European Union policy in the field of environmental protection and rational management of natural resources (Kiełczewski 2009; GUS 2013). The concept of sustainable development has gained the constitutional status in the Polish legislation (Article 5 of the Constitution of the Republic of Poland). It was also included in the Environmental Protection Act of 27 April 2001. This concept assumes the adequately and consciously shaped relationship between economic development and care for natural resources and the health and quality of life of the people. The idea of sustainable development means all the environmental activities undertaken to reduce emissions of various toxic substances and environmental pollution. However, it is also about the use of Earth's resources, so that it will be sufficient for future generations (Dobrzański 2011).

The activities for sustainable development, especially those run by municipalities with the active participation of local governments and residents, have an impact on the growth of the local development indicators (National Human Development Report Poland 2012). Opportunities for local development are visible in the ongoing education and information campaigns. Innovative local development is a collaboration of educational institutions, local governments and enterprises (Tuziak 2008). The success of these activities depends largely on the legislative and socio-economic regulations provided to municipalities in national and EU law.

Transformations that occurred in Poland in the 1990s. helped local government to inscribe permanently in the public life (Sorys 2011). The act on community self-government (J. of L. 1990 No. 16 it. 95 as amended; Ofiarska 2000) authorized the creation of associations of municipalities. The process of applying for external project funding is easier for associated communities comparing to individual ones. It resulted in a substantial boost to the budget of each municipality belonging to such association. Research suggests that the overarching goal of the associations is to improve the state of the natural environment (Borys 2010). The appropriate use of financial resources in the communities implementing projects regarding environmental protection causes the improvement in life conditions for residents and that in turn has a direct positive impact on the environment (Local Data Bank; GUS, 2013). Funds are usually allocated to the development of infrastructure, promotion, information and education. Environmental programs developed by municipalities and statutes of community associations comprise non-formal education programs. Its purpose is to increase the environmental awareness of the local society and authorities.

Non-formal education for sustainable development

Education is not only the formation and education leading to acquire knowledge, but also culture, which is particularly important in the non-formal education (Boris, 2010). This applies especially to social activities regarding the idea of education for sustainable development, the essence of which was expressed in the European Strategy for Education for Sustainable Development (2008). The idea of this kind of education is striving to achieve balance between the social and economic welfare and the environment and its resources.

The constitutions and municipal development strategies appear to have a local action of informal education on ongoing projects. The most common forms are information and education campaigns, accompanied by training, workshops and competitions. Promotional activities, design and distribution of information materials in form of leaflets, brochures and calendars dedicated to environmental protection, creation of educational paths and cooperation with local schools are activities that are often included in the projects. Municipalities and associations of municipalities may have a significant impact on the work of schools and programs implemented by them (Grodzińska-Jurczak et al. 2006).

Materials and methods

In Poland there are 223 associations of municipalities (as on 31st of March 2014), for which the priority is the implementation of tasks in order to improve the quality of the environment and to implement the principles of sustainable development. The purpose of these associations is the improvement of the environment and promoting sustainable socio-economic development of local

communities. A number of projects serve to implement this goal by municipalities. They are devoted to the improvement of water quality by water management and waste management, development of tourism and environmental education. The issue of renewable energy is also very popular among national and international projects.

3 observations and 4 in-depth interviews (Kaplowitz and Hoehn 2001) were carried out among the representatives of the two selected associations of municipalities of Malopolska and Podkarpacie. Examples of the activities allow us to assess the involvement of local decision-makers in the implementation of projects to improve the quality of the environment and to identify changes in habits and awareness of local communities.

With the participation of employees of associations and local authorities, the education-information programs have been developed. They gained approval and were accepted for financing. The training materials and trainings of the youth and teachers (the so-called "home advisors") were prepared in the scope of the campaign. They covered environment protection, nature protection, renewable sources of energy and principles of communication with inhabitants. There were also trainings worked out for representatives of partner communities and association employees. The local schools from the area of 20 communes of the association took part in campaign, i.e. more than 80 students (from 24 schools) and 24 teachers and employees.

The main goals of the campaign were:

- to increase environmental awareness of local society and administrative knowledge of officials regarding environmental protection (Gorlach et al., 2008) by conducting trainings for representatives of partner communities and employees of the associations, teachers and the youth (the so-called "home advisors") - in scope of environment protection, nature protection, renewable sources of energy and principles of communication with inhabitants,
- to encourage the selective waste collection in communities,
- to promote renewable energy and the benefits they bring among the residents of municipalities and information on currently ongoing projects,
- to acknowledge opinion of inhabitants on municipal waste management and renewable sources of energy. The opinion was checked with the use of the survey questionnaire constructed for this purpose,
- to familiarize children with the principles of caring of the environment, promote sustainable behaviour.

The surveys were conducted by trained "home advisors", students of local schools. Students involved in the campaign conducted the surveys of over two thousand respondents among whom women were in majority.

The campaign was accompanied by the information on the project in the form of postcards at schools and offices of the community and local press and TV. The ecological effect of this action is the improvement of knowledge among children,

youth and adults in the area of environmental protection regarding municipal waste management and the opportunities offered by renewable energy.

Summary

Introduction of different solutions, including principles of sustained development, and their success depend mainly on the degree of involvement of the institutions and local societies (Mazur-Wierzbicka 2005; Nowak 2012) as well as the level of knowledge by interacting entities, representatives of local authorities, residents, entrepreneurs and experts (Gorlach et al. 2008).

After the analysis of the qualitative studies it can be concluded that the involvement of the policy makers in the implementation of projects to improve the quality of the natural environment contributes to the change of attitudes, habits and awareness of local communities.

According to respondents of the interviews, projects financed from external sources affect local economic development and support the implementation of educational activities. Financial resources from both domestic and foreign funds are the major factor facilitating the activities of local authorities (Gorlach et al., 2008). The selection of methods to conduct educational activities should depend primarily on the local governments, which have the best knowledge about the specifics of the area. In most cases, these activities are organized on a small scale and are focused on specific issue. They have visible, positive effects on the changes in the environmental awareness of local communities, thereby improving the natural environment.

A comprehensive socio-economic assessment and ecological effects lead to proper use of the allocated funds and the investment plan (Hong et al., 2014). Such actions were made by the contractors of the project and already on this stage one may speak about success. These are the examples of regional development based on economic, social and environmental factors with good technical infrastructure consistent with the principles of sustained development and its environmental dimension (Nowak 2012).

The presented results of the conducted survey tests are an example of a well-organized and conducted campaign. The campaign prepared with the co-participation of employees of the associations, community coordinators and surveyors that are playing the role of "home advisors" is an another good example of actions taken for the condition of natural environment.

Local authorities should develop new methods, new information and education technologies in dealing with the inhabitants so that the commitment of Poles could bring its intended positive effect. This is of particular importance in the case of young people, who can be reached via the Internet. Consulting decisions of local authorities with residents on important issues affecting the natural environment presents the highest level of involvement of residents in public affairs (Olech and Sobiesiak-Penszko 2013).

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The Role of Associations of Municipalities in Non-formal Education

Abstract

All activities conducted by municipalities towards the sustainable development are important for environment protection – that is one of key factors of the concept of sustainable development. Therefore, developing programs and methods regarding environment protection for local communities is essential. Those programs should both provide principles of sustainable development and implement guidelines for local authorities. They should consist of educational information and suggestions of activities that may be taken by local authorities in order to engage inhabitants into the environment protection and increase their environmental awareness. This ultimately results in shifting the opinions and changing the attitudes in the community.

This paper presents the results of the qualitative research (participant observation and interviews) conducted among representatives of the selected municipalities located in the provinces of Malopolska and Podkarpacie. The involvement of the governing body in the implementation of projects to improve the state of natural environment is extensive. It also requires much effort from teachers and students of local schools. In most cases, the main objective of those projects is to achieve quality standards consistent with the EU regulations taking into account the National Environmental Policy.

According to the respondents of the interviews, projects financed from external sources directly affect development of local economy and support the implementation of educational activities. Actions in form of informal education conducted by municipalities contribute to a change in the attitude, habits and awareness of local communities and thus lead to the improvement of the quality of the natural environment. In most cases, these activities are concerned about particular field.

Key words: non-formal education, municipality, sustainable development

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The Museum Impact on the Sustainability of the City Development

Introduction

Modern societies develop in a continuous and multidimensional fashion. Smooth growth of various fields fuels social changes. It allows individuals to progress and, at the same time, it enables changes which influence the way a knowledge-based society operates. The idea of sustainable development relates to many aspects of life – the economy, culture and social growth. It also affects the changes occurring in nature and shapes local communities.

The idea is being realized in three dimensions – economic, social and ecological. The search for harmony, balance and ensuring longevity of development occurs through dedicated care for natural environment and the potential of social growth. This means that we have to care for the natural environment and its resources in such a way that would allow future generations to see and use them intact. Moreover, a balanced growth means care for education of the society in these aspects. The better informed we are about how great a treasure our natural environment is, the bigger the chance that we will not let it go to waste. The portrayal of secure and effective means of using the natural resources are the foundation of respect for nature. This notion also includes care for education, safety and appropriate living conditions for people, with understanding that we cannot destroy the potential for growth of future generations. This way we can guarantee safety of rare goods and resources, as well as continuity of development.

Environmental education in a knowledge-based society is thought to be one of the most essential means of implementing strategies of balanced growth in said society (Krzemiński 1997).

The increased importance of environmental protection and environment itself stems from the issue becoming one of the human rights – i.e. the right to a healthy environment (S. Giorgetta 2002). The notion of sustainable development can be found in The Constitution of the Republic of Poland (art. 5), which indicates that it is rooted in social awareness and cultural law, which the legislator took much from.

The term "sustainable development" was used for the first time during the UN Conference on the Human Environment in Stockholm, however it was not directly

legislated in the Stockholm Declaration. The Declaration focuses on the right to the environment, protection of natural resources, inter-generational justice, resource management and rational planning.

The idea of sustainable development was presented in the 3rd UNEP session in 1975, when it was established that a society which implements a balanced development is "a society recognizing the superiority of ecological requirements, which cannot be disturbed by the growth of civilization, culture and economy; able to maintain its development in order to sustain symbiosis with nature, respecting economic production and recycling; caring for future consequences of their actions, as well as the needs and health of future generations." The notion of sustainable development can be found in many documents produced by the UN, such as the World Conservation Strategy (1980) and the World Charter for Nature (1982). We need to remember that this notion is inseparable from the changes occurring in the environment, as well as global processes occurring in a balanced biosphere. Biological diversity is the variety of life forms, together with the genetic and ecosystem diversity in Earth scale, as well as other biological units (Potyrała 2009).

An example of a great promotion of the idea of sustainable development and raising awareness of how essential biodiversity can be is the Jardin Des Science Museum in Dijon, France. This museum is perfectly aligned with the sustainable development ideology thanks to both the contents of their expositions and the way they operate in the local community. Quoting the words of Daniel Raichwarg: "Following the idea of Biology-and-society natives, we can propose an idea of communicating biological knowledge, or rather, communicating Biology-and-society knowledge – which does not make things easier," let us consider the functions of the Museum.

Results of research

The analysis of the Jardin Museum was done using the ethnographic method. Through the review of documentation regarding the museum and the changes it underwent throughout its recent history, some observations were made and several interviews with the staff were conducted. The museum is an interesting example of "a garden of science" which, thanks to a wide and attractive offer, allows for integration of local communities with the notions connected with biodiversity and sustainable development.

The formula according to which the museum functions has changed over the recent years. The change that the Museum has undergone was not sudden. The whole process was carried out in stages. In its initial stage a project was worked out. It kept developing and evolving until it was approved by the town council of Dijon. All activities that take place at the Museum serve a specific purpose, their sense is fixed beforehand. All of the undertaken activities are a part of a long-term plan of development. The undertaken activities are to serve the local community, they are to integrate the region, to expand the knowledge of people living in Dijon.

For about five years the main subject matter undertaken by Jardin des Science Museum in Dijon has been widely understood biodiversity. The Museum focuses on biodiversity of Dijon and the neighbouring areas, it also deals with showing biodiversity of Burgundy. The current challenge is to talk about biodiversity and the natural environment. The main purpose is to propagate knowledge, encourage people to take care of the natural environment and show how important it is for the whole community to concentrate on this issue because it has by no means trivial influence on the life of the residents. Things that initially have a local nature may develop and, as a consequence, become of global meaning. For several years the museum has been intensively dealing with the subject of biodiversity and this is the main subject we can see at exhibitions at the museum. This subject area is very important for the local community. It is very important because of the cultural context – attachment to culture and the inhabited area. Employees of the museum also noticed the great importance of the question of biodiversity for better integration and the development of the local society. Informing the public about the most recent achievements of science in this context is considered to be a duty. Biodiversity is perceived as the heritage of the community, the awareness of its endurance and the necessity of maintaining it is of great importance. Asked about changing the subject matter all people agreed that at this moment biodiversity is the only subject that remains within the scope of interests of the museum.

The Museum is a venue of mediating knowledge, conveying it as effectively as possible. Because the museum is not a typically scientific place, "it is not only for scientists". Issues that are taken up at exhibitions as well as their form are adjusted to various groups of visitors. The way of presenting the collection is divided into levels in such a way that various target groups visiting the museum could "find something for themselves." The museum is the centre assembling the local community. It is not a place where you can only gain new information. You can also spend your free time there. There is a beautiful garden there, open and available to all willing visitors free of charge. Also scientific work is carried out in the museum. Co-operation with the University results in classes and common projects carried out at the Museum. The Museum also co-operates with local institutions and enterprises, tries to integrate as many groups occurring in the local community as possible.

Mediation of knowledge is an important challenge which has to be undertaken everyday at a museum. At present the main challenge for the museum is working on communicating with the public. Various kinds of activities are carried out. For example, it is connected with a wide range of types of visitors who come to the museum. Mediation of knowledge is visible in participation of various groups of the public. Visitors have an opportunity to undertake their own activity, for example through a conversation with other visitors. They have an opportunity to share their observations, ask questions, exchange views or establish new contacts. The museum is a place where they discover biodiversity. Mediators and animators try to show in what way this issue is vital for the local community and how it influences the whole

matter on a global scale. "The museum is not a university" nor it is only a scientific place. Various visitors come to the museum and so the level of the message has to be adjusted to various groups of them. The museum encourages the public to take up activities on a wide scale and in various forms. For example, it encourages visitors to take photos of insects in the field. Authors of the pictures note down where a given picture was taken, then the pictures are published on the museum's website – this is how the museum helps to see the evolution of biodiversity which occurs in the town etc. A lot of research carried out at the museum is based on material and finds delivered to the Museum by visitors themselves. Then these collections expand the country's databases. Classes for children and youth that take place at the museum are really popular. Animators present issues which are among issues discussed at school in a very interesting way – they constitute their expansion, complement them and are at the same time connected with biodiversity.

This raises the notion of yet another important aspect – the qualified staff. The traditional role of museum's staff undergoes changes. They are being replaced by people specializing in animation and mediation of knowledge. In order to assemble the most qualified staff, we need to consider some specific criteria.

One very important criterion is education: the museum favours employees who completed biological studies and studies connected with animation. A lot depends on soft competencies. A person who wants to deal with animation and mediation at the museum has to be open-minded, imaginative and know animating and mediating techniques, but first of all "he or she must enjoy sharing their knowledge with others" and "enjoy speaking". First, all employees undergo training, they learn from more experienced employees. Also, meetings are held, during which employees discuss important issues and share their thoughts. Every second week assessment meetings are held to discuss currently implemented solutions and their effectiveness, to consider implementing new and modernizing the existing ways of mediation and animation. One of the main goals of mediators is to motivate the public. To motivate them to think and to act. They try to arouse an interest in the subject, to encourage a visitor to broaden their knowledge after they have left the gates of the museum behind. The job of the museum's staff is undergoing changes all the time. It is evolving towards a widely understood mediation. More and more often mediators are not people who "know and because of that discuss various issues." The change is a two-way process. Various workshops are designed on the basis of their experience and the experience of visitors, doubts which often arise and are closely connected with the discussed issues, and the results of research etc. Employees of the Museum design, create and test new ways and models of mediation all the time. At the moment a great debate is being held on what a modern employee of the Museum should be like. Various parties are taking part in the debate: scientists, the ministry, local authorities, employees representing different positions in the museum's hierarchy. The Jardin des Sciences Museum in Dijon definitely needs natural science experts because the museum is connected with the subject of nature, with widely

understood and popularized biodiversity. The museum needs open-minded and creative people who have a wide perspective of social changes and the will to follow these changes or even to be ahead of them. An important element is the training which combines learning with improving the ways of conveying the knowledge. At the moment the museum employs about 50 people. They can be divided into 5 main departments according to their responsibilities:

- scientists – who deal with collections and exhibitions,
- mediators – who conduct trainings, animations on the premises of the Museum, work at the planetarium as well as those working at the reception – employees who are the first to contact the public,
- administration – people responsible for all administrative and office tasks,
- communication – employees responsible for contacts with the press, compiling texts to be published on the Internet, dealing with documents, leaflets etc.,
- technical staff – employees taking care of the garden, responsible for solving technical problems, who ensure the best possible functioning of electronics as well as the personnel responsible for cleanness in the buildings etc.

The choice of staff is essential as they establish contact with visitors, and their knowledge and skills decide about "the success" - meaning the integration of local communities and raising awareness of how important it is to protect biodiversity and, in consequence, sustainable development.

The Museum is an institution with a clear aim. It has a very clearly defined direction of its activities – it is a widely understood biodiversity. The subject matter includes many threads and has an ability to assemble various social groups. In its projects and at exhibitions, the Museum tries to show biodiversity from many angles and in various contexts. The exhibition "*L'amour* c'est pas si bête" presented the question of love, also from the perspective of biodiversity. An interesting and important perspective of the subject is the result of the concept work of the museum's employees. Preparation for each exhibition begins with a concept and with deciding what kind of information is to be mediated. Next, appropriate means, exhibits etc. are chosen in order to best present and illustrate the information. The next stage is to make and to present the ready exhibition. The museum focuses on active forms of mediation and animation of knowledge. The museum organizes events which assemble the local community. During such undertakings the visitors have an opportunity to see the Planetarium, the Museum – where they can see exhibits representing animals, the garden, but they also can learn about activities of local associations, for example of bee-keepers who happen to participate in such events. The permanent exhibition housed by the renovated building of the museum presents the history of life on the Earth and biodiversity connected with it. The main goal of the authors was to educate people by making them aware of the fact that biodiversity is a very important element in maintaining a balanced development. Also a very important thing for the museum is conversation. Visitors are encouraged by animators to ask questions.

Mediation of knowledge is based, among others, on a two-way process of conveying information: from the mediator to a visitor but also from a visitor to the mediator. The Museum creates an opportunity to talk, share experiences and thoughts with other visitors. It often happens that there are people among visitors who have already visited the Museum before. Each visit of this kind results in new thoughts and observations. Museologists strive for mediation of natural science to be recognized as a legal discipline – as an occupation. At present talks at the national level are being held. It is a very important issue for the employees of museums.

The museum is a part of the culture of Dijon, it is an important element connecting various groups, associations, institutions, schools etc. The first relation that is created at the museum is based on looking, the next stage is conversation. It gives an opportunity to spend free time, gain new knowledge, and broaden the knowledge one already possesses. Staying at the museum and participating in activities offered gives an opportunity to interact with people, talk, discuss many issues with others. Each relation that takes place here is a beginning of something new – it may result in new inspirations. Even the lack of new inspirations is in a way a signal that may make a given visitor think about some issue. The museum prepares periodic events which give the local community an opportunity to learn about the issues of biodiversity from different angles. An example of such an event was "A week of biodiversity" which took place in May 2014. A lot of organizations and associations were invited to help organize and participate in it. They co-operate with the Museum. A lot of different groups of visitors took part in this event: farmers, bee-keepers, schools, artists and scientists. Thanks to the presence of mediators, who organised numerous animations and also encouraged to talk, one could learn a lot of interesting and important issues. The offer was very diversified. There were attractions for many different age groups. The event attracted a lot of visitors representing various age groups.

At the Museum you can also see a film – at the planetarium, take part in various conferences or tasting of things. All these events are organized in co-operation with the local community, private businesses and organizations. During the event a great interest of visitors could be seen. They eagerly participated in all activities. They were eager to take part in conversations thanks to efficient encouragement by animators and mediators. The visitors were also willing to ask questions, take up a discussion and listen to the presented content with interest. Apart from typically educational values, the whole event was an opportunity to spend free time in an interesting way. Among the visitors there were many parents with children and a lot of elderly people. Some people who at that time were on the premises of Jardin des Science took advantage of the beauties of the garden, relaxing on the grass or playing cards. A conclusion can be drawn that the whole area of the Museum is perceived by the local community as a very friendly place. One has to remember that in this manifold way the Museum tries to draw attention to ties between people, the nature and the environment. High attendance one could observe also shows good promotion and

propagation of activities taking place at the Museum. Conversations with employees allowed to learn that the museum pays a lot of attention to promotion in the local media – newspapers, leaflets about events distributed to local hotels restaurants etc. They also believe in "an active promotion", encouraging people to visit the museum through presenting interesting exhibits in such a way so that as many people as possible had a chance to see them, for example by carrying them round the town on open platforms. The Museum's presence on the Internet is also an important element.

Thanks to its activities, the Museum encourages the visitors to think over some fundamental questions:

- Where does the "biological biodiversity" take place?
- In what way do scientists try to explain the issues of biodiversity?
- No species leads a lonely life – do we have enough knowledge about interdependence between organisms?
- What influence on biodiversity do humans have at present?
- Does mankind make its way towards a biological crisis which may lead to extinction of most species?

The whole "garden of science" is a very exceptional place not only in Dijon, but also in the whole France. It became really popular which is shown by the statistics – it is visited annually by over 100 thousand people. The key to success is certainly the fact that visitors are invited to discover the mystery of life in all its dimensions. Nature is presented here in an unconventional way – differently, closer to people. The whole staff working at the Museum is at the visitors' disposal, which is why they help visitors learn about biodiversity in the town space in the best way possible. Situating three units in one place – the Museum, the planetarium and the garden, allows for the subject matter to be presented from various perspectives. In the garden visitors can find over 500 species and varieties of plants. You can discover and understand biodiversity of wild cultivation and also the influence exerted on biodiversity by people through their activity, production and consumption. In La Roseraie de l'Arquebuse we can admire almost 230 sub-species of roses – among them the wild species as well. The design of the whole garden follows the design of English gardens, where amidst the winding lanes we can admire statues or a little body of water – a fountain. All this one can enjoy in the shadow of trees from 5 continents. Designers also took into account the needs of the visually impaired people to allow them to learn about the subject of biodiversity. In the garden there are also two conservatoires (the 19th and the 20th century) where temporary exhibitions, debates, conferences or various kinds of events are held all year long. The planetarium creates an unconventional opportunity to understand the origin of the Solar System. Mysteries of the Earth are revealed. Apart from the "cinema auditorium", where films are shown, a permanent exhibition is available. It illustrates the Solar System. Scientific facts are illustrated in a diverse and colourful

way in the "garden of science," which allows for discovering the affluence, diversity and fragility of the balance in the natural environment.

Conclusions

The Museum presents a diversity of natural environments of Burgundy in an interesting way, synthetic but also diverse. A visit there includes a lot of discussions. Mediation of knowledge, communication between visitors and animators as well as among visitors themselves often allows for various, often surprising subjects to be touched. Different points of view are very valuable because they give an opportunity of thoroughly looking at things. They allow for looking at things from an entirely new perspective.

The work done by the Museum influences the city and the local community. The variety of presentation methods of the subject of nature has a distinct effect on how many visitors come to the museum, who all belong to different social groups. Apart from standard exhibitions, the museum offers a chance to learn in different ways as well. Visitors can take part in events, performances, movie screenings or open discussions. Such contact with the local society creates the sense of a functioning community, as the museum becomes a part of the city's social network. The local population cannot only observe, but also partake in the Museum's activities. Taking part in said activities, while obtaining useful knowledge and new skills, induces the development of closer connections within the community. The flow of information and the opportunity to put new ideas forward to be seen by the public lead to great possibilities in conducting and engaging in innovative projects. The cooperation of various organizations, institutions of knowledge, government bodies and also private companies results in the creation of a thriving social network – a network of influence and interdependence, but also a source of many great benefits. The Museum's activities also raise awareness regarding nature and its heritage, thus having an impact on the population's habits towards the environment. The implementation of such gained knowledge into everyday practice will influence each individual, and in the long run, affect the local environment, as well as urban development.

The Museum is a vital link in a chain of responsibility. Its aim is the balanced growth of cities and local communities in the context of biodiversity. Raising social awareness and promotion of the ideas presented in the Jardin Museum are a good forecast for the future. The notion of sustainable development, realized by the Museum, receives a new image. It allows for the development and new initiatives which can be fulfilled by the Museum, thanks to "the network of dependencies around it." We can observe a "sustainable city," caring for biodiversity, that appreciates the role and function of a modern museum – a title which, undoubtedly, the Jardin Des Science Museum deserves.

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The Museum Impact on the Sustainability of the City Development

Abstract

Modern knowledge-based society develops in a continuous and multidimensional fashion. Smooth growth of various fields fuels social changes. It allows individuals to progress and, at the same time, it enables changes which influence the way a knowledge-based society operates. A variety of ideas and concepts are intertwined. One of such concepts - the idea of sustainable development - relates to many aspects of life – the economy, culture and social growth. The better informed we are about how great a treasure our natural environment is, the bigger the chance that we will not let it go to waste. The portrayal of secure and effective means of using the natural resources are the foundation of the respect for nature. An example of a great promotion of the idea of sustainable development and raising the awareness of how essential biodiversity can be is the Jardin Des Science Museum in Dijon, France. This museum is perfectly aligned with the sustainable development ideology thanks to both the contents of their expositions and the way they operate in the local community.

The museum is a vital link in a chain of responsibility. The main aim is a balanced growth of cities and local communities in the context of biodiversity. Raising social awareness and promotion of the ideas presented in the Jardin Museum is a good forecast for the future.

Key words: museum, sustainable development, biodiversity, local community, science and society, communicating knowledge

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Selected Aspects of the Protection of Biotopes... on the Example of the Ojców National Park (Southern Poland)

Introduction

Ojców National Park (ONP) is located in the southern part of the Kraków-Czestochowa Upland macroregion, which is a part of the "Polish Highlands" province within "Post-hercynian Western Europe" megaregion (Kondracki 1998). It occupies the space of 2 145.62 ha. It consists of two deep karst valleys: the Prądnik Valley (Dolina Prądnika) and the Sąspowska Valley (Dolina Sąspowska), both carved in limestone rocks from the Upper Jurassic Age. Numerous side canyons and gorges come down to the above-mentioned valleys. Their depth ranges from 40 to 100 m. Two permanent streams – Prądnik (12 km in length) and Sąspowka (4.5 km in length) go down the valleys. Both streams are supplied with water by about 30–50 springs. The total length of permanent waterstreams in the Park is over 17 km (Partyka 2012). The climate of the Park shows the characteristics of the mountain climate. The average annual temperatures range from 7.5°C in the flattened upper part of the Sąspowska Valley to 6.2°C at the bottom of the valley. The average annual rainfall in the valley comes to 731.7 mm (Partyka & Klasa 2008).

Vegetation of the OPN is characterized by a mosaic of plant layout. These communities are the second richest mainstay of mountain plants (5% flora) right after mountains and a valuable mainstay of xerothermic species (25% flora). Rare species make relatively high contribution to the OPN flora on a regional and national scale, for example *Aster amellus* L., *Carex pediformis* C.A. Mey, *Cerasus fruticosa* Pall., *Orobanche bartlingii* Griseb., *Stipa joannis* Čelak. s.s., *Thymus praecox* Opiz, *Verbascum chaixii* ssp. *austriacum* (Schott ex Roem, & Schult) Hayek. The presence of fungi is characteristic for the local biota, which is unique and has not been found anywhere else in the country outside of Ojców, for example *Hemimycena mairei* (E.-J. Gilbert) Singer, *Lepiota boudieri* Bres., *Agaricus placomyces* Peck, *Conocybe subpallida* Enderle, or *Merulicium fusisporum* (Romell) J. Erikss. & Ryvarden (Wojewoda 2008). One of the lichen species, *Verrucaria polonica* J. Nowak (Kiszka 2008), coming from the Prądnik Valley has already been described for the science. In addition, several

species of invertebrates inhabit these areas, which is very rare in the country, for example *Falniowskia neglectissima* Falniowski & Šteffek, *Truncatellina claustralis* Gredler (snails), *Atypus muralis* Bertkau and *Sintula corniger* Blackwall (arachnids), *Leptothorax sordidulus* Müller, *Palloptera venusta* Loew (insects). The most valuable finds here are relict species, e.g. tertiary *Plutomurus carpaticus* Rusek & Weiner or glacial *Crenobia alpina* Dana (Partyka & Klasa 2008).

The examples mentioned above demonstrate high natural values of ONP and its importance for the protection and conservation of genetic resources. The purpose of this paper is to present some issues concerning the protection of biotopes within the premises of the Park and the benefits of its implementation, as well as general importance of nature conservation in Poland.

Transformation of biotopes in ONP and conservation concept development

The aim of nature conservation in ONP is to maintain its resources, objects and components. Natural resources of the park include above all: plant communities (more than 40 distinguished in the rank of communities), vascular plants *Tracheophyta* (950–970 species), bryophytes *Bryophyta* (311 species), algae *Algae* (325 species), lichens *Lichenes* (196 species), macrofungi *Macromycetes* (about 800 species), microscopic fungi *Micromycetes* (about 420 species), slime moulds *Myxomycota* (97 species) and animals (about 7267 species, including some vertebrates 167 *Vertebrata* and about 7100 invertebrates *Invertebrata*). Among the vertebrates the most numerous group are birds *Aves* (100 species) and mammals *Mammalia* (53 species), and among invertebrates – beetles *Coleoptera* and wasps *Hymenoptera* (Partyka & Klasa 2008). In addition, natural resources of ONP include habitats, creatures of inanimate nature and landscape. ONP is on the Natura 2000 network (PLH 120004) under the Habitats Directive of the Council of Europe 92/43/EEC of 21 May 1992. A detailed list of habitats that require protection in the form of Natura 2000 areas was presented in Table 1.

Table 1. Habitat types in Ojców National Park which require protection in the form of designation of Natura 2000 sites, with indication of priority habitats (by Załącznik nr 1. Załączniki do Rozporządzenia Ministra Środowiska z dnia 6 listopada 2013 r. (poz. 1302)).

Typy siedlisk przyrodniczych OPN, które wymagają ochrony w formie wyznaczenia obszarów Natura 2000, ze wskazaniem siedlisk o znaczeniu priorytetowym (wg Załącznika nr 1. Załączniki do Rozporządzenia Ministra Środowiska z dnia 6 listopada 2013 r. (poz. 1302)).

No.	Habitat code[1)]	Name of the habitat	Priority habitat
1	6210	Xerothermic grasslands *Festuco-Brometea* and thermophilous grasslands with *Asplenion septentrionalis, Festucion pallentis*) Subtype: 6210-1 Grasslands on rocks Subtype: 6210-2 Grasslands with *Stipa* sp. Subtype: 6210-3 Flowery xerothermic grasslands	yes, so when they contain important orchid localities

2	6510	Lowland and mountain hay meadows, used extensively *Arrhenatherion elatioris* Subtype: 6510-1 *Arrhenatheretum elatioris*	no
3	7230	Mountain and lowland bogs, alkaline marshes, sedge meadows and fens 7230-P *Cirsietum rivularis*	no
4	8160	Foothills and upland limestone rubble with the communities of *Stipion calamagrostis* Subtype: 8160-1 Rubble with *Gymnocarpium robertianum*	yes
5	8210	Limestone rock walls with communities *Potentilletalia caulescentis*	no
6	8310	Caves not open to exploring	no
7	9110	Acidic beech forests *Luzulo-Fagetum*	no
8	9130	Fertile beech forests *Dentario glandulosae Fagenion*	no
9	9150	Thermophilous beech-orchid forests *Cephalanthero-Fagenion*	no
10	9170	Central European and subcontinental linden-oak hornbeam forest *Galio-Carpinetum, Tilio-Carpinetum*	no
11	9180	Sycamore-maple, lime forests on slopes *Tilio plathyphyllis--Acerion pseudoplatani*	yes
12	91E0	Willow, poplar, alder and ash forests *Salicetum albo-fragilis*, *Populetum albae, Alnenion glutinoso-incanae* and alder forests of spring niches	yes

[1)] Habitat codes based on the European Commission's interpretative manual – Interpretation Manual of European Union Habitats – EUR28 version containing amendments adopted in 2013.

Right after the ONP opening in 1956, 225 ha (14%) of the Park's surface was given strict protection, the so-called conservator-passive protection (Partyka et al. 1996–1997). In the 1970s the strict protection area has been increased to 22%. The protection also included numerous rock massifs of xerothermic vegetation occurring along the left edge of the Prądnik Valley. It was believed then that the best way to protect large areas of natural beauty is to keep it free from human interference (Szafer 1932). In the first 25 years of ONP existence no protective treatments or interventions in the natural processes were conducted (except for breeding procedures performed in some parts of the forest) (Medwecka-Kornaś 2008). It turned out that in the case of non-forest ecosystems it was a disastrous move. The combination of passive form of protection and termination of the usage of agricultural and forestry activities (according to the decree of the Prime Minister) resulted in the decrease of total area of non-forest ecosystems in ONP in the 1990s by about 70% (Bąba 1999). As a consequence of the changes described above the non-forest species composition was disturbed and the related species started becoming extinct.

It is estimated that between 1960-1996 approximately 60 species of plants related to non-forest ecosystems became extinct. In the group of herbage and shrub plants nearly 10 species died, for example *Epipactis palustris* (L.) Crantz, *Equisetum*

variegatum Schleich., *Molinia caerulea* (L.) Moench s.s., *Poa palustris* L., or *Valeriana dioica* L. s.s. (Michalik 1985, 1991b). In the 1960s there was also a decrease in the number of rare mountain plants, for example *Alchemilla walasii* Pawł. At that time this species had 21 localities in ONP, and in 1990 there was only 6 (Michalik 1996). The ecological group of flora, which in that period suffered the greatest losses, were xerothermic and heat-loving plants; the ones which died were among others: *Campanula bononiensis* L., *Carex praecox* Schreb., *Gentiana cruciata* L., *Gentianella amarella* (L.) Börner, *Hieracium echioides* Lumn., *Onobrychis arenaria* (Kit.) DC., *Orchis morio* L., *O. ustulata* L., *Orobanche alba* Stephan ex Willd., *O. lutea* Baumg., *Rosa gallica* L., *Salvia nemorosa* L. (Michalik 1990a, 1996, Michalik 2006, Sołtys-Lelek & Barabasz-Krasny 2008). Other species, such as *Aster amellus*, or *Inula ensifolia* L., reduced the area of occurrence and were threatened with extinction. The decay process of light-loving species was also observed in other taxonomic groups. For example bryophytes *Grimmia anodon* Bruch & Schimp. and *Weissia condensa* (Voit) Lindb. have disappeared as a result of overgrowth of rocks and grasslands (Stebel *et al*. 2008). The overgrowing of rocks and xerothermic grasslands resulted not only in the loss of natural, but also scenic and landscape values of ONP valleys (Sołtys-Lelek & Barabasz-Krasny 2007).

Similarly to xerothermic grasslands, ONP meadows and pastures were a subject to adverse changes. In the 1950s the bottoms of the valleys were dominated by fresh meadows of Ryegrass *Arrhenatheretum elatioris* (Br.-Bl. 1925) Koch 1926, with a balanced and rich floristic composition – an average of 50 species/100 m^2 (Medwecka-Kornaś & Kornaś 1963, Michalik 1990b, Kornaś & Dubiel 1990, 1991a, b). Since the end of the 1960s in connection with the abandonment of farming, grazing and mowing in the Park, the accumulated natural organic matter caused overfertilization of meadows, resulting in a drastic depletion of the species composition of sward. At that time the characteristic meadow species died and high nitrophilous perennials including *Cirsium oleraceum* (L.) Scop., *Rumex obtusifolius* L. and *Urtica dioica* L. spread. This established a new community which had not been previously listed in the Park. The lack of grazing led to the almost complete disappearance of grazing communities *Lolio-Cynosuretum* R.Tx. 1937, which occurred fairly commonly in the 1950s in the form of small patches.

Significant changes of the flora of meadows greatly influenced the entomofauna inhabiting them. Studies conducted in 1995-1999 showed that in the meadows mown regularly there were 21 species of flies of the *Tephritidae* and *Pallopteridae* families, in the not-mown meadows or the ones mown occasionally there were only 1 to 7 species (Klasa 2001). Witkowski (1969) observed the process of fauna change in not-mown meadows on the example of weevils *Curculionidae*. Although he did not demonstrate differences in species composition, he found a greater number of insects from this group in the mown meadows. At the same time the number of trees and shrubs polyphages in the mown meadows that had been quite rare before increased.

The aquatic biotopes were also a subject of change. According to the Statistical Yearbook of the Cracow province 1998 (*Rocznik statystyczny woje-wództwa krakowskiego z* 1998 r.) the water of Prądnik was described as not classified. Deterioration of water quality of the area resulted in the extinction of three species of bugs *Hemiptera*, 25 species of beetles *Coleoptera* and five species of caddisflies *Trichoptera* (Dumnicka & Szczęsny 2008).

Due to unfavourable changes in non-forest ecosystems, in the late 1970s people recognized the need for adjustments in the Nature Conservation conducted in ONP. However, these were individual voices which did not turn into practical solutions, and the views of conservative protection were firmly established in the minds of many people from the world of science and decision-makers (Partyka & Sołtys-Lelek 2014). Passive protection – the strict one – was still considered to be an effective strategy for the existence of plant communities. However, people began to think of ways to protect the landscape and xerothermic vegetation of the Prądnik Valley, which this park was created for. In 1985 they officially demanded the protection of biological diversity in the context of preserving the rich gene pools in the changing environmental conditions (Biderman 1990, Michalik 1991a, Medwecka-Kornaś 2008). Then the concept of the so-called active protection arose, which was meant to preserve the natural values of non-forest ecosystems, especially in small areas. The first study by S. Michalik (1985), was published, in which the author identified the needs and goals of conducting active protection. This researcher indicated an active protection zone within ONP, which also covered the idea of restitution of the natural landscape. This was a breakthrough in the discussion and perception of active protection of nature and landscape in the Park (Partyka & Sołtys-Lelek 2014).

The first experimental trial of active protection in ONP was carried out in the year 1982, in Jonaszówka – a small piece of land at the entrance of the Sąspowska Valley (Figure 1).

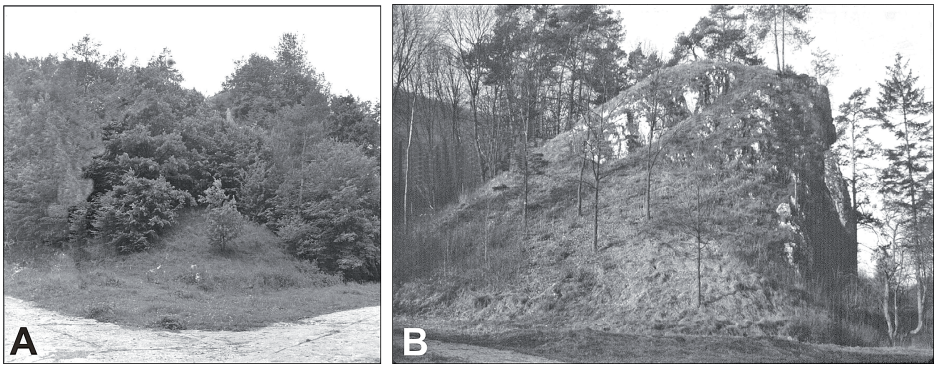

Figure 1. "Jonaszówka Rock" in Ojców National Park with the locality of Stipa joannis L.; A – year 1982, B – after partial exposure in 1995. Photo J. Partyka

A small monadnock limestone with valuable species of flora – *Stipa joannis* was discovered then. Expanding the area of these activities was only possible in 1985, after excluding 8.4 ha of the park from the strict protection, by decision of the Minister of Forestry and Wood Industry (Biderman 1990, Partyka 2001). Since then numerous planned active conservation measures on non-forest ecosystems have been conducted, including the larger massifs along the Prądnik Valley. Between the years 1982-1987 treatments were conducted fairly irregularly and referred to only 5 refuges of the xerothermic grasslands (Bąba 1999). Only since 2003 the acreage of performing active protection has been expanded. Between the years 2003–2010 protective measures covered most of the major rock complexes of the Prądnik Valley, an area of approximately 16 ha (24 refuges). In total, since the year 1982, protective measures have been conducted in 28 refuges of large rock complexes in the Prądnik Valley (Figure 2).

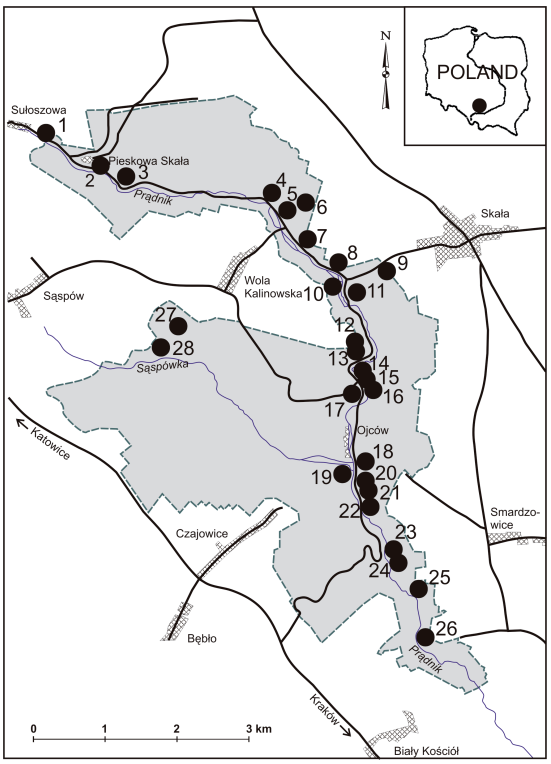

Figure 2. Refuges of xerothermic vegetation treatments under the active protection in the Ojców National Park in the years 1982–2013

1 – Kocica Rock, 2 – Pieskowa Rock, 3 – Wernyhory Rocks, 4 – Wdowie Rocks, 5 – rocks between Wdowie Rocks and Pilny Dół, 6 – Pilny Dół, 7 – between Pilny Dół and Grodzisko, 8 – Grodzisko, 9 – old quarry in Skała, 10 – rock opposite Łamańce Rocks, 11 – Łamańce, Pochylce, Ciche Rocks, 12 – Górkowa Rock, 13 – Górczyna Rock, 14 – Prałatki Rocks, 15 – Dziurawiec Rocks and Castle Rocks, 16 – Rocks above Trzaska, 17 – Góra Zamkowa in Ojców, 18 – Figowa, Ostrogi, Bystra Rocks, 19 – Jonaszówka Rock, 20 – Panieńskie Rocks, 21 – Kawalerskie Rocks, 22 – Krukowskiego Rock, Koronna Mountain, 23 – Okopy Mountain, 24 – Puchacza Rock, 25 – Krzyżowa Rock, 26 – Baszta Rock, 27 – Węzie Rocks, 28 – Zabugaje

The disappearance of biotopes for a species is the most common cause of its decline in numbers, and consequently extinction. Giving a ban on the destruction of a species is not enough to secure its sustainability if the habitat in which it occurs transforms. That is why modern protection of species emphasizes the importance of conservation of the species habitats (Pawlaczyk & Jermaczek 2008). Hence, currently the most important and essential way to protect the species richness and natural resources of ONP is to protect biotopes.

Protection of non-forest biotopes

The main threat to semi-natural non-forest communities of ONP is secondary succession towards forest-shrub communities, which results from the cessation of traditional use – mowing and grazing. This situation leads to regression, for example rocks (*Festucetum pallentis* (Kozł. 1928) Kornaś 1950) and xerothermic grasslands (*Origano-Brachypodietum pinnati* Medw.-Kornaś et Kornaś 1963, *Koelerio-Festucetum rupicolae* Kornaś 1952), spreading of shrub communities (*Rhamno-Prunetea* Rivas Goday et Garb. 1961, *Peucedano cervariae-Coryletum* Kozł. 1925 em. Medw.-Korn. 1952), followed by spreading of forest communities (thermophilic lime-oak-hornbeam forest *Tilio cordaetae-Carpinetum betuli melittetosum* or beech orchid *Carici-Fagetum* Moor 1952). The second important concern is the high degree of fragmentation of well-preserved and species-rich patches and isolation in the landscape. This is a result of both secondary succession after the cessation of agricultural use, as well as former afforestation of slopes of the valleys, for example Grodzisko, Ojców and Mount Koronna (Góra Koronna) region. This factor greatly limits the dispersion of non-forest species (Bąba 2013).

To retain valuable non-forest ecosystems of rich flora and fauna, they should be cultivated in a traditional way. Unfortunately, since the 1970s agriculture in the ONP area is not economical, so non-forest biotope protection applies only to the maintenance tasks performed by the Park. In the case of xerothermic grassland these treatments apply to cutting trees and shrubs in the first phase, and then in subsequent years, to the removal of their offshoots. At the same time the turf is mechanically mowed every year using flue gas trimmers. Mown sward is removed and exported from the uncovered surface. Treatments are carried out in late summer or autumn, after the plants had shed ripe seeds.

Even though it is believed to be one of the most effective methods of active protection of non-forest communities, ONP has not used grazing so far, with a few exceptions (Bąba 2002/2003, 2013, Pawlaczyk & Jermaczek 2008, Sołtys-Lelek & Barabasz-Krasny 2011a, b). The impact of grazing on different species varies. It is recommended to keep "the preservation of traditional usage", which means keeping grazing in such form, intensity, time and rhythm of the same species of animals or even their races, as it was done previously in the area (Pawlaczyk & Jermaczek 2008). Animal grazing on the grasslands plays a significant role, in particular for spreading the moving plant diaspores on the hair or the gastrointestinal tract (Bąba

2013, Dzwonko 2013). In year 2014, ONP conducted an experimental study on grazing on the test "Grodzisko" surface (Figure 3).

Figure 3. Experimental sheep grazing on "Grodzisko" study area, 21.06.2014. Photo A. Sołtys-Lelek

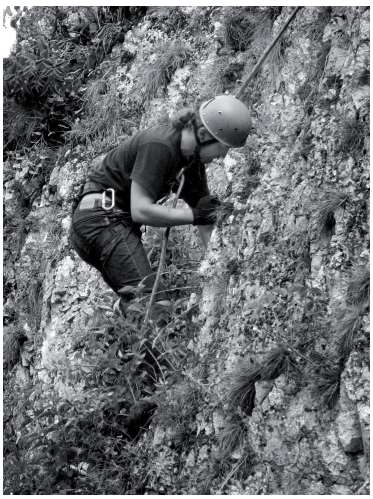

Figure 4. Removing offshoots of trees and shrubs on "Panieńskie Rocks" area, year 2012. Photo J. Ślizowski

A flock of approx. 40 sheep, of Olkusz breed, grazed from May to August on the surface of approx. 2 ha, for about 6-8 hours per day. After one season of grazing no substantial effects and changes in the species composition of grasslands could be observed, but the process evidently provoked the erosion of the slope, which will certainly be used by many grassland plants. It was also observed that the sheep were leaving offshoots of trees and shrubs, which had to be removed mechanically after the end of the grazing.

In subsequent years it is planned to extend the grazing and include other xerothermic grassland refuges. However, it is dependent on obtaining subsidies for this purpose coming from different funds supporting conservation. Costly active conservation measures of non-forest ecosystems are possible to implement, mainly due to the support of the National Fund for Environmental Protection and Water

Management. Works related to the active protection are partially carried out by employees of the Park (which refer mainly to meadows), while uncovering the steep cliffs, and treatments on the slopes of the valleys are performed by specialized companies, selected by means of tenders (Figure 4).

In parallel with the protective treatments, the Park has conducted a monitoring of changes in grassland biotopes since 1996. For this purpose, the network of permanent research plots has been selected, where detailed floristic lists are made and phytosociological relevés are taken annually or at intervals of 2–5 year. The test results clearly show the positive effect of the active treatments applied to the floristic composition and structure of the well-preserved xerothermic grasslands – the so-called "old grassland", or not strongly degraded ones (Bąba 2002/2003, 2013, Bąba & Kompała-Bąba 2011, Sołtys-Lelek & Barabasz-Krasny 2011b). This has also been confirmed in the monitoring run on bee insects living in the grasslands (*Apiformes*). The test conducted at the turn of the 1960s and 1970s on the "Grodzisko" test surface confirmed 61 species of this family. During the grassland overgrowth in the years 1985-1989 the number dropped to 21, and after the application of the active protection in 2001-2004, the number increased to 93 bee species. There were also some species found which had not been previously reported in the area of ONP, and which represented the Mediterranean and Ponto-Mediterranean geographical element, for example *Andrena pontica* Warncke, *Hylaeus cornutus* Curtis, or *Nomada sheppardana* Kirby (Partyka *et al*. 2014).

It turned out, however, that the restoration of the proper status of grassland species depends on the degree of transformation. Natural grasslands on shallow skeleton soil were slightly modified in a fluctuating way. Overgrowing grasslands in deeper soil profiles are much harder to restore. On the surface, where compact scrub developed prior to the application of treatments, grassland restoration in a short time, only by cutting, is virtually impossible (Bąba 2002/2003, 2007). Many studies show that the seeds of xerothermic plants live no longer than 5 years, so the chance to restore heavily degraded grassland with seeds lingering in the soil is infinitesimal (Loster 2013). Therefore, the presence of the so-called "old grassland" fragment rich in xerothermic flora in close vicinity is absolutely essential for seeding (Bąba 2002/2003, 2012, 2013).

Despite the annual removal of offshoots, there was an increase of forest and scrub plants reported on the highly transformed surfaces. Too frequent root repetition leads to the disappearance of small grassland plants and the dominance of grass, such as *Brachypodium pinnatum* (L.) P. Beauv. (Bąba 2002/2003. 2013, Sołtys-Lelek & Barabasz-Krasny 2011b). There may also appear some species associated with disturbed habitats, for example *Calamagrostis epigejos* (L.) Roth i *Solidago canadensis* L., which can be treated as a signal that the method of active protection used is insufficient. The grasslands that were previously covered with pine plantings seem to regenerate the best. On surfaces heavily overgrown by deciduous trees and shrubs, despite cyclical and repetitive measures of active protection, there was

a significant increase in surface coverage by shrubs of the *Rhamno-Prunetea* class, for example *Cornus sanguinea* L, *Euonymus europaea* L., or *Prunus spinosa* L., which can be perceived as a proof that there is still an ongoing succession in the direction of thermophilic scrub (Sołtys-Lelek & Barabasz-Krasny 2011b).

Meadows in ONP, just like grasslands, developed as a result of the centuries-old traditional economy, which included regular mowing, collecting hay, moderate fertilization and grazing. Active conservation measures for meadows involve its mowing once or twice including the collection of biomass. Mowing is performed by a tractor with a rotary mower. These treatments protect habitats against secondary succession, but do not bring a significant improvement in their species composition. Mechanical mowing with a tractor will certainly not substitute mowing with a scythe. Stage mowing that allows for the maturation and dispersal of propagules of meadow plants is very limited. Although the biomass is harvested, the hay is dried in the swath regardless of the weather, which means that the overfertilized soil is supplied with still nitrogen compounds favourable for nitrophilous perennial plants. In the case of the most degraded patches of grassland some experimental activities may be considered, such as overseeding of the seed harvested selectively on local meadows or transplantation of pieces of turf from the well-preserved nearby patches. It is important to conduct regular mowing, since the cessation of mowing, even for a short time, can eliminate some of the sward grassland species sensitive to shading, for example wobblers plants (Pawlaczyk & Jermaczek 2008). Despite the mistakes, active conservation measures carried out in the meadows of ONP give partially positive results. It is visible by monitoring *Bombini* bumblebees. In 1998 on 100 m^2 of meadows 18 individuals were reported on average, and in 2010 the result ranged from 16 individuals in the Prądnik Valley to 22 in the Sąspowska Valley (Partyka *et al.* 2014).

To protect non-forest biotopes effectively and to secure the associated populations the preventive measures must be conducted comprehensively. The protection of the habitat of a single patch basically means the protection of a small, isolated population of the species associated with this patch (Pawlaczyk & Jermaczek 2008). Therefore, ONP does not protect only the best preserved fragments of xerothermic grasslands and meadows, but the treatments are also apply to even impoverished and degenerate patches that do not have high natural value, but create an essential gap between the refuges.

Protection of forest biotopes

Currently, forests in ONP cover about 1529 ha, which takes up 71% of its surface. Various forms of human activity carried out here had a significant impact on the size of the forests and their species composition. In the 1960s, a mixed coniferous forest was the predominant forest community in the Park, as it occupied 38% of its surface. This dominance was associated with afforestation carried out at the end of the nineteenth century, mainly in the flattened upper part of the present

Park, where clearcutting had been performed (Suchecki 1924). The second most important community included lime-oak-hornbeam forest *Tilio cordatae-Carpinetum betuli* Tracz. 1962 – 16% of the area. A small percentage was occupied by beech *Dentario glandulosae-Fagetum* W. Mat. 1964 ex Guzikowa et Kornaś 1969 (9%), *Fagus sylvatica-Criciata glabra* (0.3%) and sycamore forest *Phyllitido-Aceretum* Moor 1952 (0.01%). In the years 1960-1990 the area covered by forests decreased to only 5% of the Park. At the same time the following expansions were reported: lime-oak-hornbeam forest (up to 40%) and the Carpathian beech forest (31%) (Partyka 2005, Michalik 2008). Retreating forests transformed into various regeneration forms of deciduous forest.

There are two types of forest ecosystems protection used in ONP: partial and strict protection. The aim of partial protection is to restore disturbed ecosystems through appropriate care and breeding measures, while strict protection is to retain the natural processes occurring in nature (Partyka 2005). The forest area under active (partial) protection is now 960.20 ha. In contrast, the surface area of strict protection in the Park in the early 1960s was 225.73 ha (14% of the area), and in 1971 it was increased to 344.08 ha, which accounted for 22% of the ONP (Partyka & Stanowski 1974). Between 1985-1995 some minor adjustments were introduced in this zone, due to the exclusion of massifs with xerothermic grasslands of its premises (Partyka 2005). As to 2013, the Park conservation area is 292.41 ha.

The process of active reconstruction of the park stands, which is performed on areas of partial protection, involves thinning and removal of species unsuitable for the particular type of habitat. It is called naturalization of stands and from the very beginning of the Park it has been one of the main protective tasks (Chwistek 2008). Sanitary cuts performed in the partial protection zone provide deadwood of such species as: *Larix decidua* Mill., *Picea abies* (L.) H. Karst., *Pinus sylvestris* L. Conifers are replaced with deciduous species, for example *Acer platanoides* L., *A. pseudoplatanus* L., *Carpinus betulus* L., *Fagus sylvatica* L., *Fraxinus excelsior* L., *Tilia* sp. (Partyka 2005). Species of foreign origin are also removed, for example *Quercus rubra* L. introduced in the 1960s. It should be underlined, however, that in most cases, restoration of natural stand in OPN was performed in the way of spontaneous regeneration, which is better than the artificial reconstruction of the stands, as the latter eliminates the possibility of natural progress and spontaneous processes in ecosystems (Buchholtz 2001, Chwistek 2008).

Strict protection of forest communities requires their complete release from the pressures of economic and human interference. To effectively preserve the richness of the forest fauna and flora of the park, strict protection encompassed old trees and forests most similar to the natural, for example beech *Dentario glandulosae-Fagetum* and, to a lesser extent *Tilio-Carpinetum* and *Phyllitido-Aceretum* (Michalik 1991c, Chwistek 2008). These areas are free from conscious human pressure, with few exceptions, when single trees growing along the hiking trails that directly threaten the safety of tourists are cut. In the forests of ONP which are under strict protection

we can observe many features of natural forests, for example spontaneous course of fluctuate processes in the locality, mosaic of habitat's groundcover, the occurrence of natural gaps in the locality, or the presence of significant amount of deadwood at various stages of decomposition (Buchholz 2001).

The increase in the surface area of deciduous forests (from 25.91% in the 1960s to 72.27% in the 1990s) as well as the fact that they were provided protection, allowed species associated with forest biotopes to return or even expand significantly. This process included many rare and valuable species for the wildlife of the Park. During the monitoring of flora an increase in the number of localities was observed, for example *Aconitum moldavicum* Hacq., *Aruncus sylvestris* Kostel., *Galium odoratum* (L.) Scop., *Phyllitis scolopendrium* (L.) Newman, *Vinca minor* L., or the mountain species *Lunaria rediviva* L. (Bodziarczyk *et al.* 2006, Sołtys-Lelek & Barabasz-Krasny 2009). In the forests of Ojców there also appeared *Allium ursinum* L., which had not been reported for 135 years and had been considered extinct in the Park. In the year 2006, the population of this species occupied the surface of 0,9 m^2 and consisted of 22 individuals, and in the year 2008 the number of plants increased to 48 individuals (Sołtys 2007, Sołtys-Lelek & Barabasz-Krasny 2011a).

Strict protection areas also protect the relict fauna of the mountain insects, such as Carpathian species *Chrysolina lapidaria* Bechyné, or ones considered to be the oldest elements of the current fauna of ONP Carpatho-Sudeten – *Trechus pulchellus* Putz. and *Stenus carpathisuc* Ganglb. (Pawłowski & Kubisz 2008). In addition, this zone determines the existence of saproxylobiotic and mycetophagous species related to fungi growing on deadwood and not present or rarely encountered in the zone of partial protection. *Gampsocera numerata* Heeger (*Chloropidae*) is an example of saproxylobiotic species which is rare in Europe and which so far has only been found in ONP and nowhere else in Poland. Another example is *Hyperoscelis eximia* Boheman (*Canthyloscelidae*), present only in Roztocze Region and the Holy Cross Mountains (the Świętokrzyskie Mountains) except for Ojców (Klasa 2004). The condition for the occurrence of these species is the presence of natural forest with a lot of dead wood. Among the mycetophagous species we may list *Agathomyia wankowiczii* Schnabl, the species preying and reproducing on the fruiting bodies of the *Ganoderma lipsiense (Batsch) Atk* fungus*.* Flies constitute an indicator of old natural forests (Klasa 2004, Klasa & Palaczyk 2005, Palaczyk 2008). Only in the zone of strict protection ONP can we find *Palloptera venusta* Loew, whose larvae probably develop in the corridors hollowed out by beetles colonizing dead wood (Palaczyk 2008). Generally, in the protection of entomofauna associated with rotting wood one should pay attention to the size of dead trees. Trees cut with combustion saws into one meter lumps provide different conditions, for instance moisture, than a several meters long tree (Figure 5). The literature also draws attention to the fact that the dead tree cut with the saw has different properties as a biotope entomofauna than the broken tree (Pawlaczyk & Jermaczek 2008).

Figure 5. Tree trunks cut into meter-long pieces along the border of the area of strict protection, 2011. Photo A. Klasa

Forest areas of ONP under strict protection constitute the biotope of the highest natural beauty and require special care in order to preserve biodiversity. Therefore, it is important to understand their resources, structure and functioning. Hence, monitoring of natural processes is allowed and what is more, it is possible for the researchers to conduct studies there.

Protection of aquatic biotopes

Given the seasonal increase in the concentrations of Na^+, K^+, SO_4^{2-}, Cl^-, NO^{3-} and PO_4^+ in 2001, the water of Prądnik and Sąspówka within ONP was classified as the second class, with periodic decrease to lower classes (Kostrakiewicz 2001). Research conducted on the Prądnik stream which was based on the Water Framework Directive (RDW) showed that the contamination varied (Niewiadomska 2006, Kowalik 2006). In the upper part, the stream was classified into the third category, and in the middle part (down to the boundaries of the Park) it was the second class of purity. In contrast, the water of Sąspówka was classified as the second purity grade in its entirety (Masiarz 2006). Spring waters in the ONP are frequently characterized as purity class II due to the relatively high concentration of nitrates, related to the delivery of sewage from rural areas (Siwek 2006). They are characterized by a high variability of nutrients concentration, which proves their high sensitivity to local pollution (Miśkowiec *et al.* 2013).

Surface waters of ONP are polluted with municipal, agricultural and industrial sewage. They are also exposed to particulate pollution and gases from the atmosphere. Until the construction of two wastewater treatment plants, municipal sewage from Skała and Sułoszowa was drained directly to Prądnik, which flows through the Park. In recent years, the problem of stream contamination has been

solved thanks to the construction of the sewerage system in the Park and the surrounding villages. Additionally, apart from several domestic ones there were four large sewage treatment plants built: in Skała (1994), Młynnik (2003, expanded in 2008), Ojców – for the Nursing Home (2004) and in the village (2009). Some additional activities would definitely improve the water quality in the Park. They above all include: inhibition of erosion on the slopes descending into the valley, the solution of the sewage problem from the "fish farm" in Ojców, systematic removal of rubbish from the rivers (Klasa & Sołtys-Lelek 2013).

In order to maintain the full diversity of aquatic ecosystems one should not just care about the purity of water but protect all habitats. Aquatic biota of the ONP is particularly sensitive to human pressure. Because of the strong impact of anthropogenic water fauna, the upper part of Prądnik is highly degraded. Fully developed clusters of aquatic invertebrates are found in the southern part of the Park, where they deserve special attention, including *Isoperla grammatica* Poda, a species threatened with extinction in Poland, as well as *Orthocladius rivinus* Potthast (*Chironomidae*), which was reported in our country for the first time in Ojców (Dumnicka & Szczęsny 2008). An important component of aquatic ecosystems are specific macrohabitats created by dead deciduous trees fallen and rotting in the current of the stream. An example of a species existing in ONP and associated with the analyzed habitat is a saprolobiotic which is very rare – *Chalcosyrphus eunotus* Loew (*Diptera: Syrphidae*), whose larvae develop in dead wood lying in the water. The habitat preferred by this species is critically endangered throughout Europe, and at the same time it is also crucial for the other flies of the *Lipsothrix* (*Tipulidae*) genus and many other taxa (Boardman 2005). Unfortunately, even in the area of ONP fallen trees, logs and branches are often removed from the river for fear of stemming the flow of water and flood risk (Soszyńska-Maj *et al.* 2009). This applies especially to the Prądnik stream, which is the main watercourse of the Park – there is a dead wood lying only on its side in the inlet pipe of Sąspówka. Therefore, it is very important for the protection of these specific habitats to raise awareness of local people about the need to preserve them and not interfere with the natural processes of nature. The example of Ojców village lying in the centre of ONP shows that even if the river flows in the boundaries of the protected area and flows through residential areas, it is difficult to keep its wild, natural character.

The main threats to the biotopes protection in the ONP

The ONP has no natural ecological connections with other protected areas and nearest forest refuges located in the neighbourhood. The lack of such connections makes it difficult for the populations to contact each other through migration, which is relevant for their genetic diversity. Only rare species of plants reach the limits of their range, for example *Arum alpinum* Schott & Kotschy, *Stipa joannis* and *Thymus praecox* Opiz, which can be found only here in Poland (Biderman & Bąba 2001). Also populations of typical forest mammals that live in the trees, such as *Glis glis* L., are

isolated here. The same applies to invertebrates associated with forest biotopes and with poor chances to move in open areas, such as *Carabus intricatus* L. On the other hand, the habitat of many larger mammals, for example *Sus scrofa* L., *Vulpes vulpes* L., or *Capreolus capreolus* L., reach far beyond the boundaries of the Park, where it is not possible to protect them. The size of the area implies the lack of predators – *Canis lupus* L. and *Lynx lynx* L., indispensable to maintain ecological balance (Wierzbowska *et al*. 2008). This requires the introduction of a controlled hunting to reduce the numbers of particular species, for example boars, which is contrary to the protective function of the Park. A small area of the Park makes many occurring populations of plants and animals quite limited and isolated from its range, or the nearest locality. They are also more susceptible to the detrimental effects of chance, which may lead to their elimination. This seems to come down to the eco-limiting factor principle, which is based on the area of the Park – the smaller the area, the greater the impact of the risks on the functioning of biotopes (Klasa & Sołtys-Lelek 2013).

There are no clear migration routes as forest belt connecting the ONP area with the closest forest complexes limits the migration. The further away from the borders of the Park, the more different barriers there are, for example heavily burgeoning buildings in the buffer zone of the Park, fences around plots and roads, etc. These factors make the migration routes of species form in strips of land with the width ranging from just a few to a few hundred meters, which is certainly not sufficient to maintain genetic diversity within the population. Widening and ensuring patency of migration corridors is one of the conditions to prevent the extinction of species in the ONP on isolated positions (Klasa, Sołtys-Lelek 2013).

Conclusions

- Active protection treatments of biotopes in patches of xerothermic grasslands have a beneficial effect on the maintenance of their typical floristic composition and contribute to an increase in the number of species of grassland; preferably it also affects populations associated with grasslands species of fauna.
- Thanks to active protection (removing bushes, mowing, grazing) landscape values of the former non-forest communities are restored.
- Strict protection (passive) is the most effective form of protection of forests biotopes and should be used widely in national parks; old trees, dead ones, decaying wood and intact groundcover are valuable biotopes for species of forest flora, fungi and lichens.
- Stand conversion may be allowed in National Parks in case of stands with the domination of alien species.
- Caring about water quality is an important factor in the protection of aquatic biotopes, but it is still not sufficient for the conservation of habitats; one of the key elements is a general reduction of human pressure.

– In order to protect biotopes and ensure their proper functioning it is necessary to ensure patency of ecological corridors which enable the exchange of genes between populations.

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Selected Aspects of the Protection of Biotopes on the Example of the Ojców National Park (Southern Poland)

Abstract

The paper contains a discussion of one of the forms of protection – the biotope protection on the example of Ojców National Park (ONP). In ONP all species occurring within its boundaries are protected as in other national parks. The biggest threat to nature in this park are changes in habitat conditions entailing the changes of the species composition of fauna and flora. Non-forest biotopes are most threatened with extinction and the main factor threatening their values is forest and scrub succession. Active protection of single endangered species conducted in some cases has not brought the expected results. Very positive results were obtained only after the entire biotopes were protected. In case of non-forest communities (mainly xerothermic grasslands and grasslands on rocks) the best form of protection proved to be active protection of biotopes and in case of forests – passive protection, conservation.

Key words: nature conservation, active protection, Ojców National Park, Poland

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Studia ad Didacticam Biologiae Pertinentia IV (2014)

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Raising Youth Awareness to Responsible Research and Innovation through Inquiry Based Science Education

From time to time, publications appear which discuss the greatest achievements of the last century, scientific successes from the past ten years, describing the development trends, prophesying the development of science and civilization in the future, together with threats and opportunities connected to them. The example of such a publication is a report authored by Andrew Maynard and Tim Harper entitled *Building a Sustainable Future – Rethinking the Role of Technology Innovation in an Increasingly Interdependent, Complex & Resource-constrained World,* which was presented during the annual *World Economic Forum* meeting in 2011 (Maynard, Harper 2011). It characterizes both developmental challenges, such as for example: increasing water deficiency, growing demand for energy, health, and food, limited resources, climate changes and trends including: global citizenship, social life in a world dominated by technology, demographic changes, increasing mobility (Figure 1).

The authors mention a number of technological innovations that have changed our world – from vaccines, new drugs and medical diagnostic methods, through getting energy from the nuclear fission and the combustion of biofuels to superconductors and intelligent materials (Figure 2).

In the next step, they indicate the "means" thanks to which these innovations were possible and which participate in the development of the above-mentioned trends. They include e.g. nanotechnology, computational chemistry, robotics, bio-interfaces, Web2.0.

In recent years, the European Union put special emphasis on carrying out and introducing the above-mentioned research and innovations in a responsible manner (*Responsible Research and Innovation* – RRI). The reason of such approach was presented by e.g. Hilary Sutcliffe, the director of MATTER (http://www.matterforall.org), in her report for the European Commission. One of the arguments is the need to take advantage of the lessons of the past and the need to avoid previous disasters, such as the large-scale use of asbestos and CFCs, and the fear of unexpected and/or

irreversible consequences of new discoveries, resulting inter alia from the increasing scale of influences and time pressure during the decision making process. Another factor supporting the need for RRI is a growing distrust for the achievements of science among the public, which may be due to the high advancement of knowledge necessary to understand the innovations introduced.

Figure 1. Global trends (Maynard, Harper 2011)

Technology Innovations			
Vaccines	Carbon sequestration	Smart grids	Better health diagnostics
Advanced sensors	Soil management	Smart materials	High conductivity materials
Next generation electronics	Efficient resources use	Bottom-up manufacturing	Safer nuclear power
Point of use energy generation	Climate control	Renewable energy sources	Substitute materials
Better food preservation	Resilient crops	Immersive communications	Targeted pesticides
Smart drugs	Increased land productivity	High value crops	Biofuels
Water desalination	Thermal insulators	Efficient resource extraction	Water separation
Strong, lightweight materials	Irrigation	Disease management	Sustainable production processes
Automated traffic management	Better batteries	Advanced prosthetics	At-source water purification

Figure 2. Technology innovations (Maynard, Harper 2011)

Responsible Research and Innovation is characterized by:

1. The choice of research topics and product innovations in terms of achieving (as a consequence of their use) social or environmental benefits.
2. Constant commitment (from the beginning to the end of the innovation process) of society, including non-governmental organizations and other groups that are aware of the public good.
3. Evaluation and effective prioritization of impact, risks and opportunities – social, ethical, and environmental, now and in the future, in parallel to consideration of technical and commercial aspects.
4. Supervision mechanisms, better anticipation of problems and better management of problems and opportunities, as well as the ability to adapt and react quickly to variations in circumstances and changes in the state of knowledge.
5. Openness and transparency as an integral part of the research and innovation process (Sutcliffe 2014).

As in case of many other new initiatives coming partly from outside of the society of researchers from the natural sciences field (but affecting them directly), the following questions immediately arise in the research community: why do I have to inform the public about my research? And who actually should I inform? What will the benefits be? Would it not be just propaganda activities? What if someone from outside the group of scientists question the research that I am working on**? Is RRI a false or illusory need, or rather an essential component of growth and progress?** It is a natural and healthy symptom of a critical approach to reality. It is not a negative attitude to the question of responsibility for ongoing research, but rather caution in adopting new regulations and recommendations. The thing is worthy of a wider discussion.

It is also worth stressing that even without the pressure from the European policymakers, the scientific community has been trying to define the standards of practice through the so-called *Codes of Conduct* for years, for example *The Chemical Professional's Code of Conduct* prepared by the American Chemical Society. According to this document, people involved in professional chemistry confirm their responsibility in relation to the public (e.g. "Public comments on scientific matters should be made with care and accuracy, without unsubstantiated, exaggerated, or premature statements"), the science of chemistry (e.g. they should "understand the limitations of their knowledge, and respect the truth"), the profession (e.g. "Conflicts of interest and scientific misconduct, such as fabrication, falsification, and plagiarism, are incompatible with this Code"), their employers (e.g. chemists should "perform the work honestly, competently, comply with safety policies and procedures, fulfil obligations, and safeguard proprietary and confidential business information"), their employees, students, colleagues (e.g. "they should show consistent respect to colleagues, regardless of the level of their formal education and whether they are from the industry, government or academia, or other scientific and engineering disciplines"), clients, and the environment (e.g. "they have a responsibility to

understand the health, safety and environmental impact of their work, to recognize the constraints of limited resources, and to develop sustainable products and processes that protect the health, safety, and prosperity of future generations").

In order to make the society familiar with the RRI concept, the European Commission introduced this topic into the grant competition, e.g. within the framework of activities coordinating and supporting the FP7-SCIENCE-In-SOCIETY-2013-1 programme, activity 5.2.2 Young people and science, topic SiS.2013.2.2.1-1 Raising youth awareness to Responsible Research and Innovation through Inquiry Based Science Education. In this competition, the grant project named IRRESISTIBLE (*Including Responsible Research and innovation in cutting Edge Science and Inquiry-based Science education to improve Teacher's Ability of Bridging Learning Environments*) received funding. It is coordinated by the University of Groningen (The Netherlands) with a Polish partner – the Jagiellonian University (Faculty of Chemistry and the Museum of the Jagiellonian University – Collegium Maius).

The aim of IRRESISTIBLE is to design the activities that will foster the involvement of students and the public in the process of Responsible Research and Innovation through: developing teaching materials, providing training courses, organizing projects and student competitions, preparing interactive exhibitions. The awareness of RRI will be raised in two ways: by increasing content knowledge about research by bringing topics of cutting edge research into the teaching program of science subjects; and through fostering a discussion among the students about RRI issues both in formal teaching (at school) and in informal teaching (in science centres, museums, and science festivals).

What distinguishes the IRRESISTIBLE project from other educational projects is the close cooperation of scientists and people involved in education. Teams were formed in each country, called the *Community of Learners* (CoL). Such communities are formed not only by upper secondary school teachers and natural science educators, but also by designers of interactive exhibitions (employees of scientific museums, science centres) as well as scientists. "A Community of Learners can be defined as a group of people who share values and beliefs and who actively engage in learning from one another – each partner is both a learner and a teacher; learners from teachers, teachers from learners, and learners from learners." [4] Everyone, learning from each other, will collaborate in the development of teaching modules to work with students at schools and for informal education purposes. In the second phase of the project, the task of teachers – participants of the first CoL (team of learners) – will be to train the next five colleagues from the school teaching staff (Figure 3).

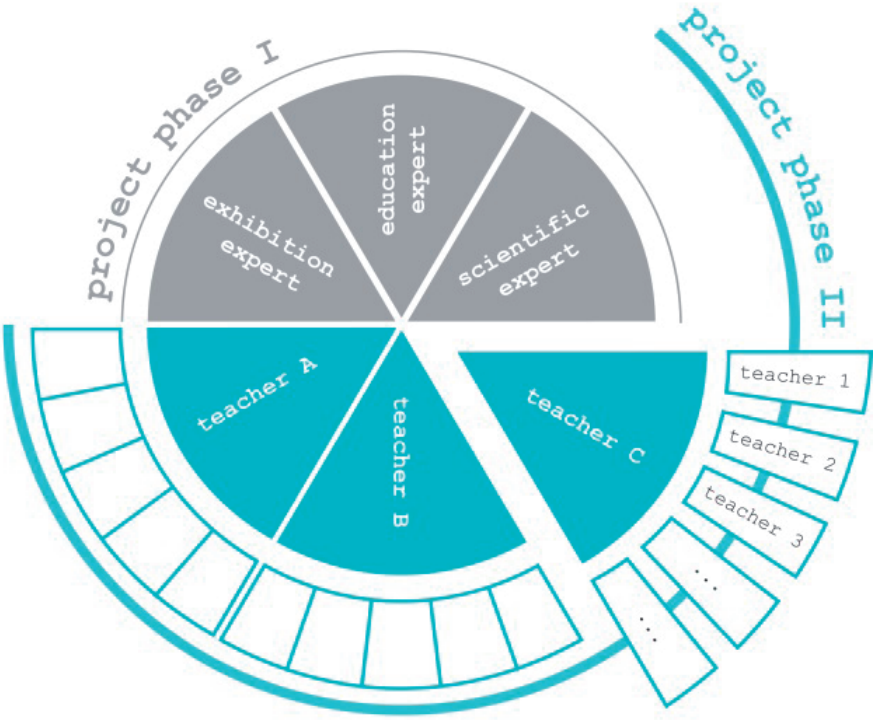

Figure 3. Two phases of work of the teams of learners of the IRRESISTIBLE project

Six key issues of RRI will be included (in an appropriate scope for a particular educational project) within the IRRESISTIBLE:

- Engagement – joint participation of researchers, industry and civil society in the research and innovation process,
- Gender equality – unlocking the full potential of society e.g. through the modernization of human resources management in scientific entities,
- Science education – increasing the interest of children and adolescents in natural science, science and technical sciences; education that equips future scientists and general public with the necessary knowledge,
- Ethics – respect for fundamental rights and the highest ethical standards, increase of societal relevance and acceptability of research and innovation outcomes,
- Open access – free, on line access to the results of publicly funded research,
- Governance – the responsibility of policy makers to develop harmonious models for RRI (*Responsible Research*...).

Modules of teaching materials for teachers and students will be based on the IBSE – Inquiry Based Science Education implemented in the context of modern, responsible research and innovation. The 6Es method will be applied in the project activities with students:

- **E**ngage – Students are introduced to the subject by a visit to the local science museum, studying exhibits related to the research subject. They use web-activities to learn more about the subject.
- **E**xplore – They go to a lecture by the researcher about the research being done at the university. In class they discuss the connection to the curriculum and identify questions about the subject (step 1 in IBSE)
- **E**xplain - They now start the second part of the IBSE, finding answers to their questions, either by experiments or by finding the necessary knowledge. In the classroom their answers are transformed into the knowledge they need to answer the question asked. It is also indicated which knowledge is needed within the curriculum.
- **E**laborate – The idea of RRI is introduced and applied to the research subject that was studied. On the web, in the science centre or during a visit to the university these issues are discussed by the students with the researchers.
- **E**xchange - The students build an exhibit/poster in which they demonstrate the RRI issues they have identified. The exhibits are collected in the science centre and displayed there. The exhibits can be judged, so the best exhibits may receive a prize.

The subject of the proposed courses will include a number of different areas, in which the project partners are specialized:

- Healthy ageing – food, food production (University of Groningen, the Netherlands),
- Genomics and oceanography (Universidade de Lisboa, Portugal),
- Climate changes from the perspective of fields dealing with the atmosphere and oceanography (IPN in Kiel, Deutsches Museum in Monachium – Germany, University of Jyväskylä, University of Helsinki, Finland),
- Renewable energy sustainability (Weizmann Institute of Science – Izrael, Valahia University Targoviste – Romania),
- Nanoscience applications (Bogazici University – Turkey, University of Crete, Eugenides Foundation Greece),
- Nanotechnology (University of Palermo, University of Bologna, Italy),
- Catalysis in environmental protection (Jagiellonian University, Poland).

Just as the scientific and economic community is sometimes sceptical about RRI, also in the teaching community in Poland the following questions arose: can nanomaterials and technologies be taught at school? Is it not a level of polytechnic/ university education? – here, those who were interested were invited to take a look at the example at the website of the "Time for Nano" project – http://www.timefornano.

eu/pl/. The Warsaw University of Technology was one of the participants of this project. Where can a place for new content in a seemingly overloaded and strictly defined by learning outcomes Polish teaching curriculum be found? - this is where one of the solutions seems to be a simple use of this modern subject as a context for nature classes in upper-secondary schools, for classes dealing with the scientific methods, science dilemmas, etc. What can be a source of knowledge for a teacher on topics that he/she did not have a chance to become familiar with during the studies? Answers to all these questions will be provided successively at the website of the project: http://www.irresistible-project.eu.

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Raising Youth Awareness to Responsible Research and Innovation through Inquiry Based Science Education

Abstract

This paper refers to an idea of Responsible Research and Innovation (RRI) and methods of its promotion. The educational project IRRESISTIBLE, proposed in the 7th Framework Programme, has been described there. The need for some kind of research code of conduct comes among others from the need to avoid past disasters, such as the large-scale use of asbestos and CFCs, and from the fear of unexpected and/or irreversible consequences of new discoveries. What distinguishes IRRESISTIBLE from other educational projects is the close cooperation of various groups, such as: teachers, science educators, researchers and museums in the so-called Community of Learners. The teaching materials developed will refer to cutting edge science discoveries and facilitate the introduction of RRI issues using Inquiry Based Science Education (IBSE) at schools and in the framework of non-formal education (implemented in the cooperation with museums and science centres). This paper raises a series of questions related to the introduction of modern research into schools, e.g. whether nanotechnology can be the context for teaching the basic chemical and physical

concepts, already included in the school curriculum, such as the issue of scale, size depending properties etc.

Key words: Responsible Research and Innovation, educational projects, informal education, Community of Practice

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Studia ad Didacticam Biologiae Pertinentia IV (2014)

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Forms of Knowledge Popularization at Universities

Along with industrial and post-industrial changes in Europe, the discussion about different forms of learning began. It became clear that educated citizens contribute more to the development of the country (CEDEFOP, 2003). This is how completely new forms of learning were initiated: self-regulated learning, which allows us to manage the learning system on our own, context learning – learning from the context and experience, lifelong learning – learning our entire life, incidental learning and non-formal learning (Bois-Reymond 2008). Creating a society based on knowledge is mostly done through the popularization of learning, learning management and its diffusion. The most crucial element is collecting data, presenting them in the right order and working out the way to present data in a more approachable way (Malczyk 2011).

The popularization of knowledge aims at bringing back the communications and building a creative, mutual dialogue. It also tries to build a bridge between the process of learning and society, and raise social awareness and as a consequence, also responsibility for their lives (Potyrała and Walosik 2011). Propagating knowledge is based on creating the right attitude towards nature and environment. It also relies on constantly adjusting the science data materials to the recipients. By joining the process learning with a social and economic life, we create a great room for action and development. The interest in the particular field of knowledge raises the hunger for information, which can be satisfied through reading, learning, experimenting or a simple conversation (Malczyk 2011).

During their studies, students gain knowledge, various skills, formulate certain attitudes required on the future job market. A human being is only able to control his life if certain useful problem-solving skills are developed early (Domagała-Kręcioch and Majerek 2014). Student's organizations, such as different study groups, or taking part in events like "science festivals", "open doors" or "science night" gives students a chance to become "a building Man" – according to Borkowska's theory, which means acquiring moral, cognitive and emotional resources. The core of its existence consists of personal values such as health, freedom, responsibility, courage

and dignity and relations like: friendship, love, a need to bring help, an ability to forgive, kindness and tolerance. Due to these values a man constantly 'becomes' – in the sense that he experiences reality, evaluates it, which makes his existence multidimensional (Domagała-Kręcioch, Majerek 2014).

Student learning groups are the form of informal education, performing merely a propagating function. They associate students interested in the particular field of knowledge. The group becomes an alternative provider of educational elements. The participants have a chance to extend their knowledge and their practical skills, creating social behaviour and learning creative thinking. For many students, participation in such a group is the only chance to develop talents and gain self-discovery. It also gives them a chance for "peer-learning" – which means learning from their colleagues. This gives them an opportunity to reconcile two forms of learning. However, the most important factor in the learning group is self- motivation, essential for self-development in the society based on knowledge. The main purpose of the group is to raise interest in science, research and self-development, popularized in student's environment. The members of the learning group organize conferences, trainings, symposia, seminaries or workshops. These meeting are very often the only chance for young people to get a job or internship. Moreover, members have an opportunity to participate in science projects or to publish articles about their research. They take part in science events, festivals or other activities organized during science camps. In those cases, youths learn also through incidental learning, which enables them to assimilate culturally and socially.

Another interesting form of popularizing knowledge are Science Festivals (Figure 1). They become more and more popular and are usually conducted in different, interesting ways. They can consist of experiments, lectures, shows, workshops or trips. They also extend to different fields of science. They have a strong regional background, as they are often organized by local authorities. Festivals are organized in order to gain new knowledge and to share it with others. People responsible for organizing them often focus on encouraging the audience to participate in different contests and performances. This way the participants have an opportunity to experience the mysterious world of science by themselves. The variety of themes and forms makes such festivals popular among younger and older generations. Festivals, apart from propagating knowledge, perform a social function. They are the place of integration of students and their teachers. Various tasks and activities during festivals are very often a challenge also for scientists. During their lecture they learn to use a different language, more comprehensive and more approachable for their listeners. So not only do they have to convey the meaning to the audience that is not particularly familiar with the terms and definitions but also do it in an interesting way in order to raise the students' curiosity and inspire them to develop their own thoughts and research (Rosner 2003). Festivals are also a good way of getting to know the scientific institutions, which are often perceived as hard to approached and comprehend. The participants of those festivals often

get familiar with the specificity of a particular area of science, they can perform experiments in the laboratory, use a specialized equipment and meet their teachers and scientist in person.

The "Day Open" events are a form of promoting universities. Participants have a chance to find out something about the departments, faculties and specialties offered by the school. These actions are mostly focused on popularization of knowledge among school students (Figure 2). Young people who take part in such events usually look for inspiration and try to find some new idea for life. Very often their previous dreams or expectations are verified because they realize that a particular job was not meant for them. The propagating role of the "Day Open" should be based on the authentic presentation of a particular university, its potential and possibilities, as well as its department and faculties. It should also give a chance to meet the scientist and absorb the unique atmosphere among students and teachers. The young participants can feel like students, take part in lectures, workshops and experiments. "Day Open" events are very often the only chance for a young person to get familiar with a future student life.

Another form of popularizing knowledge at universities are science camps. The participants are usually people interested in different areas of science. The camps give them an opportunity for getting new experience and knowledge as well as expanding the already existing one. The chance of meeting people form a different area of interests often leads to some further cooperation afterwards. Meetings at such camps frequently result in various projects, publications and research. A great example seems to be the camps organized for the students of nature and environment. Students are given a chance to widen their knowledge when it comes to biology of animals and plants, getting familiar with their morphology and anatomy as well as some practical training during the experiments. Very often those practical training and work outside the lab proves to be more beneficial than standard lectures and studies. They also lead to various projects such as the student science group "Blackbird" at the University of Gdańsk, which organized an ornithological camp in Kwieciew (April – May 2008). Another example can be the members of Krakow University of Technology, building department that, along with the administration of the Kenozierskiy National Park, organize various science camps located in the park, which focus on stalk taking of village farms, chapels and churches. All those examples prove the importance of science camps and indicate their role in propagating knowledge and learning.

Students engaged in the popularization of knowledge ought to be supervised by academic teachers, who are supposed to serve as role models for young learners. A good teacher is constantly trying to improve his qualification in different scientific fields, because only is this way is he able to raise student's interest and show them his competence. Moreover, while performing his duties he should pay attention to universal timeless values. A teacher should pay attention to stimulate the listeners' intellect and not only deliver simple facts (Kiełb-Starczewska 2012). His role is to

convey new messages as well as extend the already existing ones, create new skills and develop hidden talents of his listeners. Such teacher also needs to engage his students in propagating knowledge and learning. In this way they become more involved and learn how to make their own decisions and not just imitate the already given formulas. With time they will also develop a sense of team work and the ability to conduct their own lectures one day.

Figure 1. The XIII edition of the Science Festival in Krakow

Figure 2. Day Open at Pedagogical University of Cracow, 2013

Duraj-Nowakowa (1999) claims that through contact and interaction with at least one great teacher in their life, a student usually gets strongly influenced by his knowledge and experience and treats him as a model to follow and in some way imitate. A mastery of a great teacher can be especially observed during his interactions with students, where he can show his didactic skills, cultivate important values, both moral and ethical, and what's most important, convey their genuine meaning to students who will comprehend, accept and respect them (Denek, 2011).

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Forms of Knowledge Popularization at Universities

Abstract

The popularization of knowledge is a process aiming at propagating and disseminating learning in an approachable, interesting and intriguing way. The main role of popularization is first of all to make a person interested of a particular brand of science and formulate an appropriate attitude towards nature and environment. The key part in this process is played by universities. Both scientists and students engaged in the promotion of learning are the important factor in propagating knowledge. There are many ways of disseminating science, such as science festivals, the Day Open at Universities or student camps. The main purpose of those events is the popularization of both learning and the profession of scientist as such. The participants have a chance to become familiar with some new, interesting facts as well

as to cultivate the already existing ones. In this way they have a chance to feel like scientists themselves.

Keywords: popularization, university, knowledge, science

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